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A JOURNAL ISSUED QUARTERLY BY THE

VIRGINIA ACADEMY OF SCIENCE

New Series | January, 1956 | No. 1

VOL. 7, NEW SERIES JANUARY, 1956 No. 1

THE VIRGINIA JOURNAL OF SCIENCE

PUBLISHED FOUR TIMES A YEAR: IN JANUARY, APRIL, JULY, AND SEPTEMBER, BY THE VIRGINIA ACADEMY OF SCIENCE

Printed by *The Giles County Virginian*, Pearisburg, Va.

CONTENTS

Pages

Clovene and β-Caryophyllene Alcohol—ALBERT W. LUTZ AND EVANS B. REID 1

The Postembryonic Development of the First Pleopod of *Cambarus longulus longulus* Girard (Decapoda, Astacidae)—C. W. HART, JR. 9

Cat Chromosomes—LADLEY HUSTED AND GEORGE WALKE8 14

Distribution of Poisonous Snakes on the York-James Peninsula: A Zoogeographic Mystery—OLLIE KING GOODWIN AND JOHN THORNTON WOOD 17

Observations on the Mayfly Fauna of a Stream in Central Virginia—JEAN E. PUGH 22

News and Notes 29

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Entered as second-class matter October 31, 1955, at the post office at Charlottesville, Virginia, under the Act of March 3, 1879. Subscription—$3.00 per volume. Published four times a year: in January, April, July, and September, by the Virginia Academy of Science at Charlottesville, Va.

Mailed January 28, 1956

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THE VIRGINIA JOURNAL OF SCIENCE

VOL. 7, NEW SERIES JANUARY, 1956 No. 1

Clovene and β-Caryophyllene Alcohol [1]

ALBERT W. LUTZ AND EVANS B. REID

The College of William and Mary and Colby College, Waterville, Maine

The tricyclic monounsaturated sesquiterpene, clovene, is reported to be formed from the dicyclic β-caryophyllene by a variety of methods. Using the Bertram-Walbaum reagent (glacial acetic and dilute sulfuric acids) the oily hydrocarbon (clovene) together with a solid tricyclic alcohol, $C_{15}H_{26}O$, β-caryophyllene alcohol, is obtained (Wallach and Walker, 1892). Because of its extreme resistance towards oxidizing agents the alcohol was assumed to be tertiary in nature, with the hydroxyl group probably located on a bridge-head carbon atom. This assumption was supported by the observation that β-caryophyllene alcohol failed to be regenerated from the dehydration product, clovene, suggesting that dehydration was only effected with concomitant structural rearrangement.

The recent X-ray crystallographic determination of β-caryophyllene alcohol chloride (Robertson and Todd, 1953) not only confirmed the original deductions concerning the bridge-head structure of the alcohol, but established the structure (I) and the stereochemistry of the molecule as well.

Sundry other preparations of clovene have been reported in the literature, but it is apparent from the variations in their physical constants that clovene has never been adequately characterized and that, owing to the lack of solid derivatives, no satisfactory criterion for either the purity or the identity of the terpene is available except its degradation to the dicyclic dibasic clovenic acid obtained in 40% yield (Ruzicka and Gibson, 1931).

DISCUSSION

In our work with clovene it was considered essential to obtain pure material. Hydration with Aschan's reagent (sulfuric acid monohydrate in ether) furnished the expected β-caryophyllene alcohol and crude clovene, together with very low yields of α-caryophyllene alcohol, and a new hydration product, $C_{15}H_{26}O$, m.p. 70-71°. In most of our work, isolation was accomplished by using superheated steam (about 160°), and under these conditons no α-caryophyllene alcohol was obtained. It seems justified to conclude, therefore, that at the higher isolation temperature α-caryophyllene alcohol is completely dehydrated to clovene.

Fractional distillation of this crude clovene through an efficient column gave fractions boiling from 114.5° to 128.5° at 12.0 mm., with $\alpha_D^{25.0}$

[1] A resume of the original paper published in J. Chem. Soc., 2265 (1954).

EDITOR'S NOTE: For this paper, Albert W. Lutz and Evans B. Reid were awarded the J. Shelton Horsley Award at the Thirty-third Annual Meeting of the Virginia Academy of Science. It is published here upon the request of the editors.

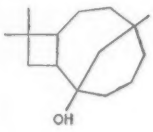
varying from −20.24° to −54.21°. An infra-red absorption spectrum of an intermediate fraction proved identical with one later reported by Eschenmoser and Günthard (1951) for their clovene purified by distillation.

Bromination of clovene (purified by distillation) gave, in relatively poor yield, a solid mixture of isomeric dibromides that was distillable *in vacuo* (b.p. 153-162°/1.0 mm.) with only slight decomposition. Fractional crystallization from ethanol furnished the major isomeride, m.p. 71.0-71.5°, and the minor isomeride, m.p. 41-43°. These appeared to be the first crystalline derivatives to have been prepared from clovene, and very pure specimens of clovene (b.p. 115.0°/12.5 mm., $n_D^{25.0}$ 1.4913, $\alpha_D^{25.0}$ −23.37°) were regenerated from each dibromide by extended treatment with zinc dust. It is of significance that the bromine atoms in these isomerides are extremely inert. Thus, treatment of either dibromide with refluxing alcoholic potassium hydroxide for 3 hours was without effect, and in boiling ethanol solution the action of zinc dust was only slight after three hours. Also of significance is that our very pure clovene furnished, on oxidation, clovenic acid in high yield. In this connection we also satisfied ourselves that the formation of clovenic acid proceeded without skeletal rearrangement (cf. Byers and Hickinbottom, 1948), for the crystalline acid was formed by oxidation wtih chromic acid, alkaline permanganate (very slowly) or by the action of ozone followed by hydrogenation and then oxidation.

In the Wohl-Ziegler reaction, ordinary clovene reacted very sluggishly and incompletely with N-bromosuccinimide. Isolation, *via* short-path distillation, furnished a dark yellow, unstable product which gave very low analyses for bromine. It was concluded that clovene probably contained no hydrogen atoms alpha to the double bond, and our attention turned to clovenic acid as a starting point for degradative work.

Strong indications that the two acid groups in clovenic acid were attached to tertiary carbon atoms were provided by the following: attempts to prepare the di-acid chloride with oxalyl chloride (Adams and Ulich, 1920) gave only clovenic anhydride; ammonolysis with gaseous ammonia on dimethyl clovenate resulted in only unchanged ester; the application of the Schmidt reaction yielded only anhydride; and failure of the diagnostic test characteristic of tertiary acids (Bistrzycki and Mauron, 1907). The latter failure is due to preferential anhydride form. The above experiments, when considered in conjunction with the stability of the acid towards nitric acid and other oxidizing agents (Blair, 1935) and towards isomerizing conditions (Barton, Bruun, and Lindsey, 1952), together with the facts that the acid resists bromination and ketonization (Ruzicka and Gibson, *loc. cit.*), can only be accommodated by a di*neo*pentyl system, as in (II).

Reduction of clovenic acid to the corresponding glycol (V) should thus furnish a structure containing two *neo*pentyl groupings. In view of the work by the Whitmore school (Whitmore and Fleming, 1933; cf. Ingold,



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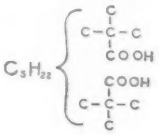

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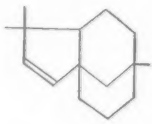

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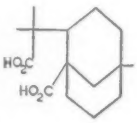

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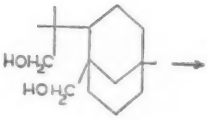

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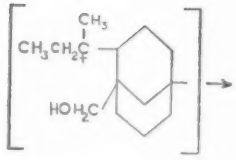

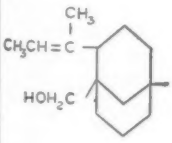

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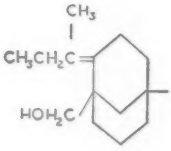

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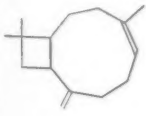

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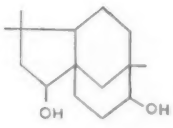

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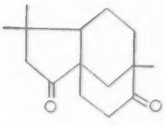


(XI)

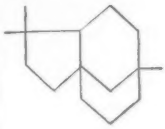
1923) on rearrangements in the *neo*pentyl system, it seemed reasonable to expect that an analogous rearrangement by the glycol, with concomitant dehydration, should give unsaturated products of predictable structures, amenable to degradation. Thus, if expression (III) is adopted for clovene (Barton, Bruun, and Lindsey, *loc. cit.*; Eschenmoser and Günthard, *loc. cit.*), reduction of clovenic acid (IV) should yield the glycol (V), which on dehydration would be expected to furnish a mixture of olefins (VI and VII). It may be noted that the second carbinol grouping, since located on the bridge-head, would not be expected to be involved in the dehydration with rearrangement, since the requisite ring expansion from C6 to C7 would locate the positive charge at the bridge-head, and stabilization *via* proton expulsion would result in formation of an ethylenic bond at the bridge-head of a system wherein S is less than ten (cf. Fawcett, 1950).

Lithium aluminium hydride reduction of either dimethyl clovenate or clovenic acid resulted in smooth formation of a gummy, hygroscopic, immobile oil that was characterized through its crystalline diphthalate. On dehydration with fused potassium hydrogen sulfate one molecule of water was lost, with formation in good yield of a substance of m.p. 12.5°. Quantitative hydrogenation and acetylation, and semiquantitative bromination studies, proved this to contain about 10% of unsaturated alcohol, the rest being inert ethereal material that showed in the infra-red a strong absorption at 9.0 μ (1111 cm.$^{-1}$) (ether absorption). It is thus apparent that dehydration mainly proceeded to form the cyclic ether (VIII) (compare the ready dehydration of clovenic acid), there being very little of the hoped-for dehydration with rearrangement.

Oxidation of the above mixture of dehydration products with potassium permanganate in pyridine furnished a degraded keto-dicarboxylic acid, $C_{13}H_{20}O_5$, m.p. 178-180° (depressed to 149-150° on admixture with clovenic acid), in low yield (apparently derived from the unsaturated alcohol), together with the main product, a neutral material, m.p. 93.0-94.5°, $C_{15}H_{24}O_2$. The latter was completely inert to basic hydrolysis, bromination, and oxidation, and showed no carbonyl reactions, behaviour reminiscent of that of the presumed lactone obtained by treatment of clovenic anhydride with phenylmagnesium bromide (Blair, *loc. cit.*). It was completely stable to excess of refluxing hydrobromic-sulfuric acid for 30 hours and was unaffected by chromic anhydride. The extreme stability of our product must be due to steric effects. That this material was a lactone (derived from oxidation of the cyclic ether) was confirmed by a strong absorption band 5.88 μ (1700 cm.$^{-1}$) in the infra-red (oil paste).

While other experiments to establish dehydration conditions that would furnish workable yields of rearranged products were performed, no satisfactory results were obtained.

Earlier work in these laboratories by Mr. N. W. Atwater and elsewhere (Barton, personal communication) had shown that β-caryophyllene (IX) can be cyclized by either of two methods to a tricyclic glycol (X), the structure of which has been adequately characterized by the English



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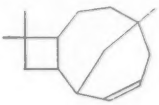

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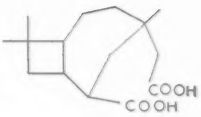

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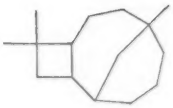

(XV)

group led by Professor D. H. R. Barton. The relation of the carbon skeleton of the glycol, and its derived diketone, to that postulated for the clovene (III) is obvious. We have therefore transformed both the diketone (XI) and clovene into a common structure, clovane (XII) by quantitatively hydrogenating clovene and, in 76% yield, by Wolff-Kishner reduction of the diketone.

The above transformations, when considered in conjunction with the ultimate degradation of the glycol (X) to clovenic acid (Aebi, Barton, and Lindsey, 1953) unequivocally establishes the same carbon skeleton in clovene as the glycol. If structure (III) is accepted for clovene a direct relation should exist between clovene and β-caryophyllene alcohol (I), since dehydration with Wagner Meerwein rearrangement of the latter would be expected to furnish the hydrocarbon. Indeed, the literature contains statements in support of this dehydration (Wallach and Walker, 1892; Henderson, McCrone, and Robertson, 1929). Careful repetition of this dehydration (phosphoric oxide) has shown, however, that while the product closely resembles clovene in so far as its boiling point and refractive index are concerned, its rotation is of opposite sign, its infra-red absorption spectum shows distinct differences, and its chemical behaviour is completely different. Thus, in contradistinction to clovene, the new dehydration product, which we termed *pseudo*clovene, forms an unstable compound with bromine and on oxidation forms an oily dibasic acid isomeric with clovenic acid. Although clovenic acid is ditertiary, *pseudo*clovenic acid must contain α-hydrogen atoms, for it undergoes substitution in the

Hell-Volhard-Zelinski reaction, forming a dibromo-acid that was characterized through its dimethyl ester. Further, *pseudo*clovene must contain hydrogen atoms alpha to the double bond, for, unlike clovene, it reacted smoothly with N-bromo-succinimide to form an unstable bromo-derivative.

Clovene and *pseudo*clovene must therefore be structural isomers. The number of configurations that can be drawn representative of a dehydration product and containing the required grouping —— CHCH = CHCH —— is strictly limited, and on the basis of the evidence at hand, formula (XIII) is tentatively proposed for *pseudo*clovene, and (XIV) for *pseudo*clovenic acid.

The question naturally arises of the role of β-caryophyllene alcohol in the formation of clovene from β-caryophyllene. The alcohol was recovered unchanged when treated with Aschan's reagent under conditions used in the preparation of clovene, or with boiling 20% sulfuric acid for 4½ hours. Use of much more vigorous conditions, however, than obtain for the hydration of β-caryophyllene, *i.e.*, in ether-concentrated sulfuric acid at 75° for 1 hour, gave a mixture of an unsaturated hydrocarbon (25%), not clovene, and a saturated hydrocarbon (75%). The formation of the latter is reminiscent of Oddo and Scandola's reduction (1909) of several alcohols to alkanes by sulfuric acid. In our case ether-sulfuric acid was used, and preliminary cleavage of the ether to ethanol would furnish a readily oxidizable component. The structure of our saturated hydrocarbon must be (XV), for oxidation of the hydrocarbon mixture with chromic acid resulted in the formation of β-caryophyllene alcohol. The formation of caryophyllene alcohol in this reaction was shown to be due to oxidation and not to hydration of a double bond (which would have to be located at the bridge-head), since the same reaction conditions, but without the oxidant, failed to yield the alcohol.

It thus is established that despite the logical structural relation between β-caryophyllene alcohol and clovene, it is not possible to effect the transformation in the laboratory. From this it must be concluded that the hydration of β-caryophyllene with Aschan's reagent takes at least two paths: in one the relatively stable β-caryophyllene alcohol is formed; in the other, clovene and other products are produced. It also seems certain that these two paths are mutually exclusive and presumably involve different ionic intermediates.

SUMMARY

Evidence is advanced to show that clovene, as ordinarily obtained, is a mixture of isomeric sesquiterpenes inseparable by distillation. Bromination of ordinary clovene yields a mixture of two stable isomeric dibromides which, upon fractional crystallization, have yielded the first solid derivatives of this oily terpene. The oxidation of pure clovene furnishes clovenic acid in high yield, and additional evidence has been secured proving that clovene lacks hydrogen atoms alpha to the double bond.

The reduction of clovenic acid furnishes a glycol that is extremely resistant to reagents that usually effect the *neo*pentyl rearrangement. Dehydra-

tion with potassium hydrogen sulfate gives, as the main product, a cyclic ether that is adamantine to ring fission and on oxidation furnishes a very stable lactone.

The carbon skeleton of pure clovene has been shown unequivocally to be identical with that of a tricyclic glycol, the structure of the latter being established by Barton and his co-workers.

Whilst β-caryophyllene alcohol would be expected to yield clovene on dehydration with Wagner-Meerwein rearrangement, and is so reported in the literature, this is shown conclusively not to be the case. Instead, a new structural isomer of clovene is obtained, termed *pseudo*clovene.

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The Postembryonic Development of the First Pleopod of *Cambarus longulus longulus* Girard (Decapoda, Astacidae)

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University of Virginia and Randolph-Macon Woman's College

Andrews (1911), Hobbs (1940, 1945) and Hart (1953) have studied the first pleopods of certain male crayfishes with reference to their structure and homologies. These studies have all been concerned with the adult animals of the subfamily Cambarinae and of the genus *Cambaroides*.

It is therefore the purpose of this paper to give an account of the postembryonic development of the first pleopod of a member of the Cambarinae, and to point out that at no time in its development does this appendage exhibit the biramous condition characteristic of the other abdominal appendages. Penn (1943) has briefly described the growth of the first pleopod of *Cambarus clarkii*, and the present study is an enlargement of this theme.

The following cursory description is based on more detailed earlier work (Hart, 1953).

A Description of the First Pleopod of Cambarus longulus longulus (fig. 10). The first pleopod of this crayfish is essentially a relatively stout appendage which terminates in two distinct parts which are bent caudad at approximately 90° angles to its longitudinal axis. Proximally the appendage is heavily developed and this basal portion has evidently become so modified as to render any trace of a fused coxopodite and basipodite invisible.

At the mid-point of this appendage and on its caudal face is the caudal prominence "P" which corresponds to a similar structure in *Cambaroides*.

The mesial process "A" (Andrews' "spatula", 1910) is a strongly developed bulbiform tumescence folded over the sperm groove to the caudomesial face where it ends as a swollen conical tip directed caudad. Cephalad of the base of this protuberance arises the falcate central projection "CP" (Andrews' "canula", 1910) which curves abruptly caudad and ends in a more or less pointed corneous tip. This projection is the result of the fusion of two elements (Hobbs, 1940; Hart, 1953), and they, together with their constituent membranous parts, form the walls of the end of the sperm groove.

The Development of the Pleopod. The adult crayfishes of the genus *Cambarus* usually molt two times a year, once in the spring and once in the late summer or fall. The young, however, while undergoing more rapid growth, molt more often.

It is assumed that each of the stages represented in figures 1 through 8 represents a successive instar, and that from the time the egg hatches until the pleopod reaches the stage of development shown in figure 1,

two molts have taken place. This assumption is based on the fact that the newly hatched crayfishes have an average carapace length of 3.5 mm.; in the second instar it is 4.1 mm.; and in the third instar, when the first pleopod becomes evident, it is 5.3 mm. The pleopod shown in figure 1 is from a crayfish with a carapace length of 6.5 mm. It appears that there are three ecdyses between the stage when the crayfish hatches and when the pleopods are elongate with the general form shown in this figure.

During the first two instars the first pleopods of the male crayfishes are not visible. In the third instar, however, the pleopods are seen as minute papillae which are relatively far apart and which protrude caudally from the sternum.

In the fourth instar the basal and distal "segments" are clearly delineated (fig. 1) and the distal "segment", the endopodite, (Hart, 1953: 294) shows evidence of the mesial longitudinal groove which later plays an important part in the sperm transfer of the adult crayfish. The pleopod is now slightly curved and is directed mesiocephalad, the tip having just begun to turn in what will later be its characteristic right angle bend.

As the crayfish increases in size, the first pleopods, which are relatively far apart in the young animal (fig. 10) are brought closer together, as a result of an increase in thickness at their basal portions. When sexual maturity is reached, they are considerably closer together, and the sternal sclerite has developed into a heavy transverse ridge on the ventral portion of the first abdominal segment (fig. 11).

In the fifth instar (fig. 2) the tip of the pleopod is somewhat larger, but otherwise there is little difference between it and the fourth, except for size.

The sixth instar (fig. 3) shows the longitudinal groove in the endopodite somewhat deepened, and the mesial edge of the fold begins to show a slight protuberance about its mid-point where the mesial process will later become evident.

In the seventh instar (fig. 4) the tip of the pleopod almost completes its right angle turn, and the longitudinal groove achieves considerable depth. The cephalic [1] surface of the pleopod shows an increase in thickness distally, and the folding over of the sides of the longitudinal groove is accentuated here although the two sides have not yet grown over the groove to such an extent as to close it and form a tubule.

In the eighth instar (fig. 5) the endopodite first shows that characteristic tumescence, the caudal ridge, on the basal half of its caudal surface which will later become more accentuated. Otherwise there is little difference from that form exhibited by the previous instar, except, of course, that it is larger.

In the ninth instar (fig. 6) the overlapping of the two above-mentioned masses in completed and the tubule is seen for the first time as a completed

[1] "The caudal surface is . . . . that surface broken by the longitudinal groove and the cephalic is that surface which is generally held against the sternum of the thoracic region" (Hobbs, 1942: 56).

structure. The mesial process also takes on its swollen hemispherical shape.

The pleopods of the tenth instar (fig. 7) show little difference from those of the preceding one, and it is well to remember that the pleopods thus far considered are all of the second form.[2]

The figure of the pleopod of the crayfish in the eleventh instar (fig. 8) is from an animal with a carapace length of 13.9 mm. The smallest first form male of the many observed had a carapace length of 14.0 mm.: the majority of the first form males being considerably larger, i.e., 17-27.5 mm. For this reason it is assumed that sexual maturity, i.e., the primary molt to the first form, is attained when the crayfish has a carapace length of between 14 and 17.5 mm. It is of interest to note that the small first form crayfish mentioned above was from Keswick Creek, a stream eight miles east of Charlottesville, Va. on route 22, and that the entire population of *Cambarus longulus longulus* in this stream consisted of individuals of a smaller average size than those taken elsewhere.

Figure 9 is a typical second form pleopod and figure 10 shows the typical first form male pleopod.

Thus it is shown that at no time in the development of this pleopod, which development is wholy postembryonic, does it show any tendency toward a biramous condition so typical of the other pleopods.

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[2] Every adult male of the subfamily Cambarinae exhibits two distinct morphological types. These are usually referred to as "first" and "second" form males or as 'form I" and form II'. When the crayfish becomes sexually mature, these two forms, being associated with the reproductive cycle, alternate at successive molts — the first form is the breeding stage and is distinguished by the presence of a corneous condition of the central projection (fig. 10 "CP") of the first pleopod, and the second form is the non-breeding stage in which the central projection of the first pleopod is blunt and never corneous. The juvenile males are morphologically similar to the second form adult males. (See Harris, J. A.—1901. The Dimorphism of Cambarus I. *Kan. Univ. Quart.*, 10(2): 49-59.)

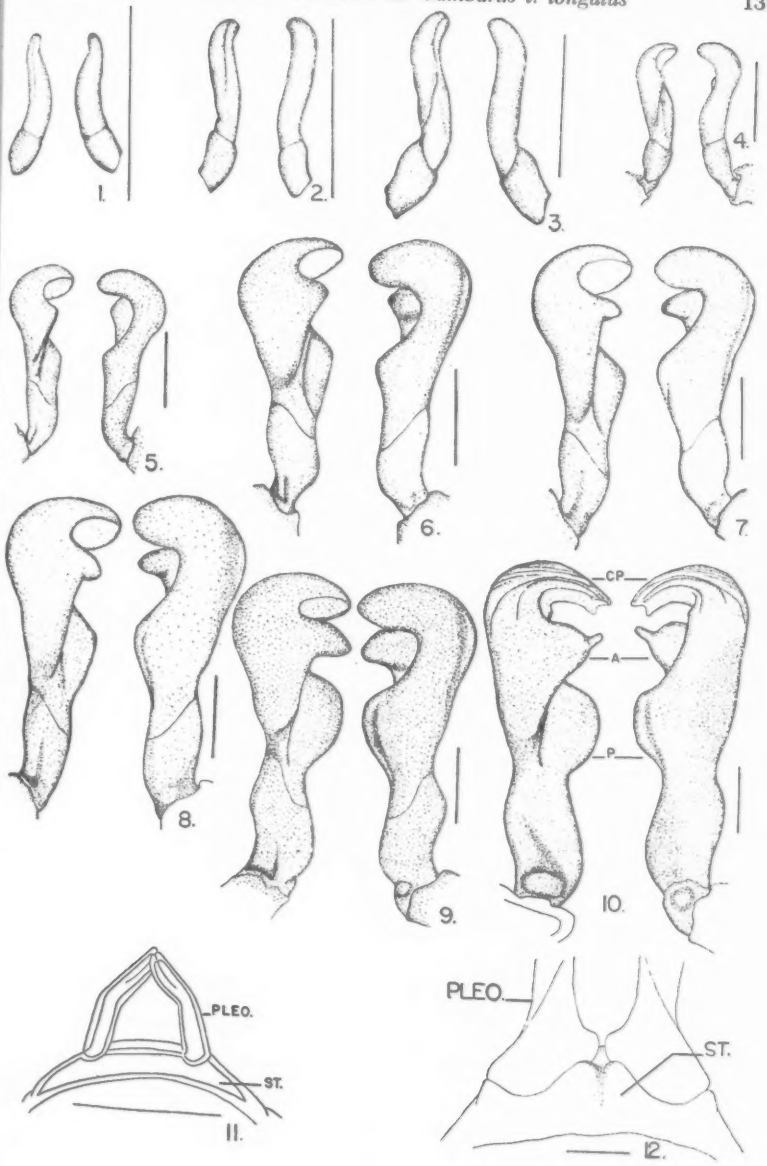
EXPLANATION OF FIGURES

FIGURES 1-10. Mesial and lateral views of the first pleopod of the male crayfish *Cambarus longulus longulus*. Vertical lines represent one millimeter.

FIGURE 11. Caudal view of the sternum and pleopods of the first abdominal segment of male crayfish. (Fourth instar). Horizontal line represents one millimeter.

Figure 12. Caudal view of the sternum and basal portions of the pleopods of the first abdominal segment of first form male crayfish. Horizontal line represents one millimeter.

A. Mesial process
CP. Central projection
P. Caudal ridge
Pleo. Pleopod
St. Sternum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Cat Chromosomes

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The house cat, *Felis domestica*, has been the object of numerous cytological studies. Twenty-three of these have dealt almost exclusively with the chromosomes. The chromosomes of this species were first described in a series of papers by Winiwarter, beginning in 1909. The number of chromosomes ($2n = 38$) was reported correctly by Gutherz in 1920. His observation was subsequently confirmed by Minouchi, Minouchi and Ohta, Matthey, Winiwarter, Koller, Vara and Pesonen, and Makino and Tateishi (see Makino, 1951, and Makino and Tateishi, 1952). Since 1928 it has been accepted generally that the sex chromosomes of the female cat are represented by two X chromosomes, and the male cat by an X and a Y. There is lack of agreement, however, as to certain details of the morphology and behavior of these chromosomes.

In a recent publication dealing with the chromosomes of the lion, *Felis leo*, the Chinese leopard cat, *Felis bengalensis*, and the house cat, Makino and Tateishi (1952) have reported a similarity in the chromosomes of these species. In the three, the X chromosome is described as larger than the Y. The X chromosome of the house cat and the Chinese leopard cat is depicted as twice the length of the Y, and the X of the lion as longer.

Koller (1941) described the sex chromosomes of the cat in some detail and writes that "the chromosomes of the diploid complement can be arranged in a series of 19 pairs. A comparison of chromosomes has shown that a 'heteromorphic' or unequal chromosome pair, which would represent the X and Y sex-chromosomes, is absent, which suggests that the two sex-chromosomes are apparently very similar in size."

We recently have had occasion to examine the testicular tissue of a domestic cat and are unable to confirm the difference in size reported by Makino and Tateishi. The observations we have made agreed more nearly with the earlier observations of Koller.

Aceto-carmine preparations of testis tubules were made according to the method of Painter (1939), and paraffin sections were cut after tubules were fixed in San Felice and stained by means of the Feulgen reaction.

The chromosomes of 8 spermatogonial cells at metaphase were drawn with the aid of a camera lucida and arranged in pairs most nearly identical. Three of these are shown in figure 1. It is clear that a pair, one chromosome of which is twice the length of the other, as depicted by Makino and Tateishi, is not found in this material. The two sex chromosomes, whichever they are in figure 1, are similar in size, as previously reported by Koller.

In over 400 spermatocytes at metaphase I a few configurations were found which are like those shown in Koller's figures 16 and 17. These

are rod bivalents. The free arms are identical or nearly identical in size. In no cell was it possible to identify with certainty an heteromorphic pair like that in Makino and Tateishi's figures 3B, and 4C.

Since the rod bivalent, similar to the one considered to be the X-Y by Koller, was seen in less than 10 percent of the cells, it is possible that chiasmata are formed between both arms of the X and Y chromosomes with a higher frequency in our cat from the District of Columbia than in the cats which were examined by Koller.

The observations reported here are incidental and somewhat limited. They indicate that a re-examination of the sex-chromosomes of *Felis leo*, *Felis bengalensis*, and some consideration of other of the Felidae are to be desired.

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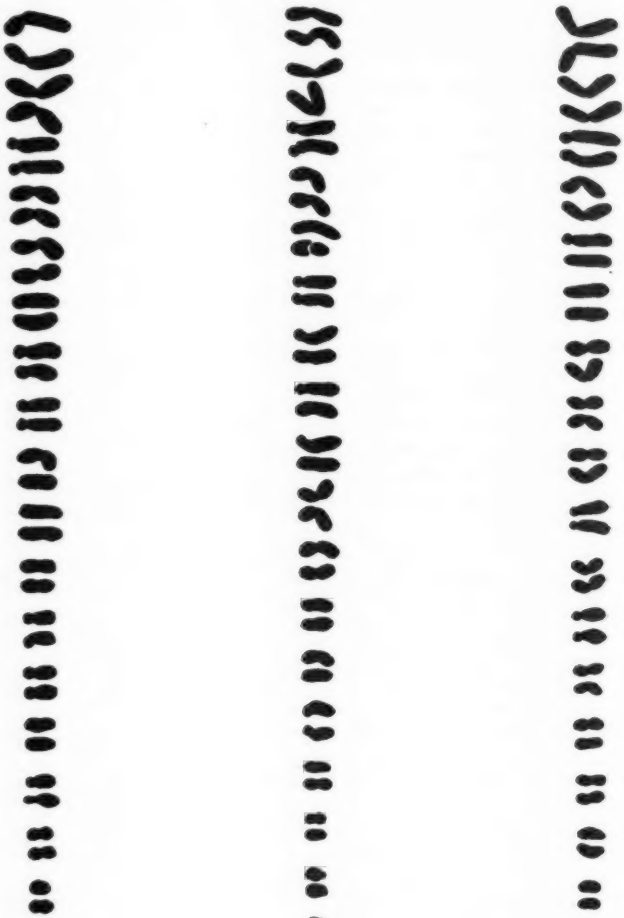

FIGURE 1.—Chromosomes from three spermatogonial cells of the domestic cat. X 2020.

Distribution of Poisonous Snakes on the York-James Peninsula: A Zoogeographic Mystery

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Warwick, Virginia and University of Virginia

Reported here is the remarkable distribution of the two species of poisonous snakes found on the Virginia coastal plain peninsula bounded by the James River on the southwest, the Pamunkey and York Rivers on the northeast, and Chesapeake Bay on the east. The two indigenous venomous snakes are the copperhead (*Ancistrodon contortrix mokeson* Daudin) and the cane-brake rattlesnake (*Crotalus horridus atricaudatus* Latreille); the cottonmouth water moccasin (*Ancistrodon piscivorus piscivorus* Lacepede) is the third poisonous snake found in southeastern Virginia, but it has never been found north of the James River (Wood, 1954). Some confusion has resulted from the several widely used common names of the rattlesnake on the York-James peninsula, but all specimens examined in the course of this study were referable to the above subspecies; the timber rattlesnake (*Crotalus horridus horridus* Linnaeus) is not found east of the foothills of the Blue Ridge in Virginia, and the eastern diamondback rattlesnake (*Crotalus adamanteus* Beauvois) has never been found north of North Carolina.

Carroll (1950) states that rattlesnakes are more common than copperheads in the eastern swamp areas along the James River drainage. While this was an impression shared with Werler and McCallion (1951) in regard to the poisonous snakes of Princess Anne County, it has not been substantiated by subsequent work. Wood (1954) showed that copperheads have been recorded as often as rattlesnakes both north and south of the river. The curious distribution of these two species north of the James, however, is worthy of note.

The York-James peninsula is a broad tongue of land extending for 75 miles southeastward from the Fall Zone (at Richmond) to the Chesapeake Bay; all of the peninsula lies in the Coastal Plain. The narrowest point is near Grove, York County, where the rivers lie within six miles of each other, and the widest zone bridges Charles City and New Kent counties; the average width of the peninsula is 18 miles (Roberts, 1932). The eastern end of the peninsula consists of three cities, as follows: Hampton (including all territory formerly in Elizabeth City County); Newport News; and Warwick (including all territory formerly in Warwick County). Proximal to these cities are four counties that lie entirely on the peninsula, as follows: Charles City, James City, New Kent, and York. Portions of two counties extend down from the Piedmont to form the western end of the peninsula, Hanover and Henrico. The area of the peninsula discussed in this report, Map 1, includes all of the above cities and counties

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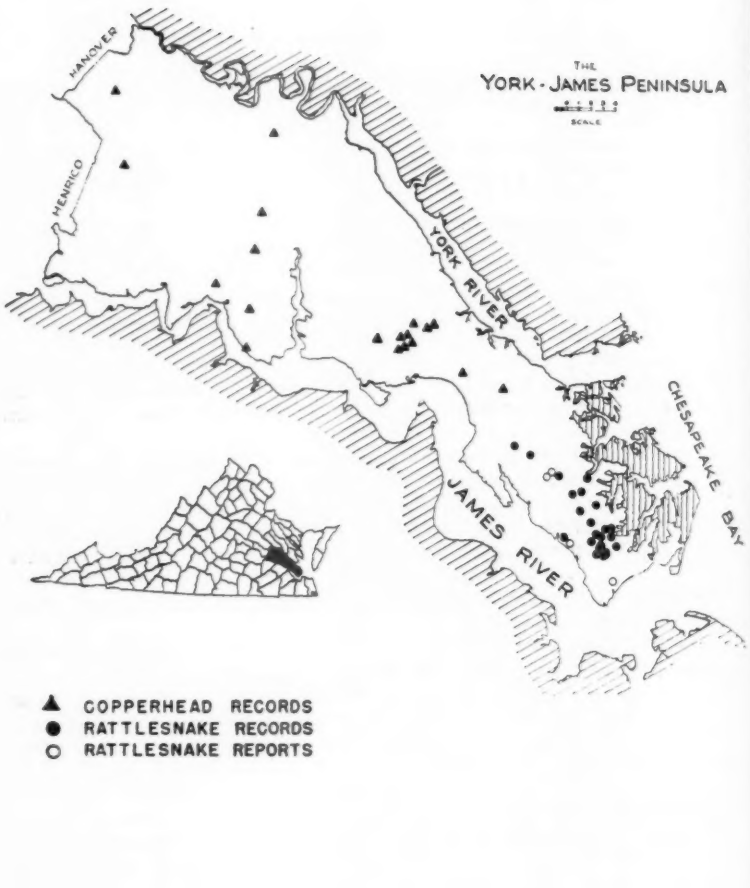

MAP 1.—Distribution of Poisonous Snakes in the York-James Peninsula.

except for the portions of Hanover and Henrico, and consists of 796 square miles.

The rivers isolating the peninsula from adjacent counties are broad, especially around the eastern half of the region. Although the James is wider than the York along the margins of the lower peninsula, it may not constitute a greater natural barrier to the distribution of terrestrial fauna since the latter is far more brackish over almost all of its course. The James River (from the Chesapeake Bay to the mouth of the Chickahominy River) ranges in width from 1.2 miles at Jamestown Island to 5.7 miles at Burwell's Bay; the York (from Chesapeake Bay to the New Kent-James City county line) ranges in width from 0.5 miles at Yorktown to 2.2 miles at Queen Creek. The margins of the peninsula are deeply serrated by a number of swampy creeks.

The northeastern extremity of the peninsula consists of extensive mud flats and brackish marshes along a fragmented coastline from Yorktown to Buckroe. In this area (shaded in Map 1) the maximum elevation is 10 feet above sea level; no venomous snakes occur in this zone. The southwestern half of the eastern end of the peninsula is entirely unlike the northeastern half, and consists of greater elevations, freshwater swamps, extensive hardwood and coniferous forests, and a fauna that includes poisonous snakes. It closely resembles the habitats to the west, in James City, Charles City, New Kent, and York counties.

Records upon which Map 1 is based came from three sources: collections of museums and herpetologists; medical records of snakebite accidents; and chance encounters by individuals.[2] All specimens from the region were examined, and all reports were critically evaluated and if undoubtedly valid, were included. The distribution of specimens on Map 1 reflects the inequality of field work and reports from the western counties, and is in no way related to relative or regional abundance of the snakes. Copperheads range from the Fall Zone (at Richmond) southeastward for a distance of approximately 55 miles to the "belt line" at Grove, York County. They are the only poisonous snakes found in this region. Localities are as follows:

COPPERHEAD DISTRIBUTION

CHARLES CITY COUNTY.—

Holdcroft (MCV 4851); Roxbury (MCV 118675); 2 mi. NW. of Sandy Point on James River (OKG G-5) (JTW-3104); 4 mi. W. of Chickahominy River bridge, Rt. 5 (JTW-3515); 8 mi. W. of Chickahominy River bridge, Rt. 5 (J.T.W.).

JAMES CITY COUNTY.—1.5 mi. S. of Eastern State Hospital, Dunbar Division, on Rt. 615 (JTW-895); Lake Matoaka Park, Williamsburg

2. Abbreviations in locality lists: MUSEUM AND PRIVATE COLLECTIONS: **CM**—Carnegie Museum, Pittsburgh; **JTW**—J. T. Wood collection; **OKG**—O. K. Goodwin collection. MEDICAL RECORDS (HOSPITAL PROVIDING): **BH**—Bell Hospital, Williamsburg; **MCV**—Medical College of Virginia Hospitals, Richmond. OBSERVERS: **J.T.W.**—J. T. Wood; **O.K.G.**—O. K. Goodwin; **V.D.M.**—V. D. McManus, Williamsburg; **W.L.B.**—W. L. Burger, Champaign, Ill.; **W.R.M.**—W. R. Mears, Warwick.

(W.L.B.); Eastern State Hospital grounds, Williamsburg (JTW-2334); College of William and Mary campus, Williamsburg (JTW-3103); 0.5 mi. S. of College of William and Mary, Williamsburg (JTW-3208); Williamsburg (BH-200303) (MCV-34023); 4 mi. N. of Lee Hall on Rt. 168 (J.T.W.).

NEW KENT COUNTY.—Quinton (MCV-4819) (MCV-4231); Walker (CM-30691); 5 mi. N. of Diascund Bridge (CM-30695).

WARWICK (CITY).—2 mi. N. of Lee Hall, Rt. 174 nr. Rt. 238 (JTW-1002).

YORK COUNTY.—0.5 mi. N. of Williamsburg, Rt. 60 by-pass (JTW-1493); 1.5 mi. E. of Williamsburg, Colonial Pkwy. (JTW-1494); 9.0 mi. W. of Yorktown, Colonial Pkwy. (JTW-2333).

From the narrow "belt-line" of the peninsula near Grove, York County, to Chesapeake Bay the canebrake rattlesnake has an exclusive domain of about 130 square miles; this is the only area on the Virginia coastal plain where, in consequence of extensive field work, copperheads have not been found. Localities are as follows:

CANEBRAKE RATTLESNAKE DISTRIBUTION

HAMPTON (CITY).—124 Patrician Dr. (OKG-G-18); 847 Todds Lane (OKG-G-7); 1 mi. S. of Bethel Reservoir, Bethel Rd. (OKG-G-22); Rt. 623 at Rt. 600 (OKG-G-6); 1.5 mi. SW. of jct. Rt. 611 and Rt. 612 (OKG-G-2); 1.0 mi. E. of Foxes Store (OKG-G-15, G-16, G-17); 1.5 mi. E. of Foxes Store (OKG-G-9); 2.0 mi. NNW. of Foxes Store (OKG-G-19, G-20, G-21); 0.25 mi. NW. of Foxes Store (OKG-G-23); 498 Whealton Rd. (OKG-G-25); 402 Winchester Dr. (OKG-G-26); Rt. 613, 1 mi. SE. of Rt. 258 (OKG-G-27).

NEWPORT NEWS.—25th St. and Salters Creek (OKG—unverified newspaper report).

WARWICK (CITY).—1 mi. E. of Morrison (V.D.M.); 1.5 mi. NE. of Morrison, Rt. 306 (OKG-G-4); 1.5 mi. N. of Denbigh (JTW-3355); 30 River Rd., Hilton Village (Death due rattlesnake bite); 1 mi. S. of Denbigh, Rt. 60 (OKG-G-8); Rt. 618, 1.5 mi. E. of Rt. 168 (OKG-W.R.M. unverified report); Rt. 618 at Rt. 17 (OKG-G-12, G-13); 1 mi. SE. of jct. Rt. 258 and Rt. 623 (OKG-G-14); 0.5 mi. NW. of Harpersville (OKG-G-10); 1 mi. W. of jct. Rt. 168 and Rt. 618 (OKG-W.R.M. unverified report); Main St. and Warwick Rd., Hilton Village (OKG-unverified newspaper report); 17th St. and Wickham Ave. (OKG-G-24).

YORK COUNTY.—2 mi. NW. of jct. Rt. 601 and Rt. 134 (OKG-G-1).

The surprising point about the distribution is not that the canebrake rattlesnakes do not extend farther to the west, for they are in the extreme northeastern end of their geographic range, but why the copperheads are absent in the area supporting the rattlesnake population on the lower York-James peninsula. South of the James River there are similar habitats, and the species are found in the same localities in seemingly identical ecological situations.

ACKNOWLEDGMENT

The authors are indebted to all persons and institutions who contributed observations, records, and specimens upon which this study is based. Particular thanks are due to the Daily-Press, Inc., of Newport News, for their cooperation in bringing reports of rattlesnake distribution to the attention of the senior author.

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Observations of the Mayfly Fauna of a Stream in Central Virginia [1]

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University of Virginia [2]

Interest of the author in the mayfly fauna of the Piney River in central Virginia was stimulated in the spring of 1953 when several trips were made to this area to study aquatic insects. On one of these occasions a large number of adult mayflies were seen swarming, and the question arose as to how many species of mayflies might occur in the area. The opportunity to answer this question was made possible when several members of the University of Virginia faculty initiated an ecological survey on the river. The writer's cooperation with this project began in June, 1953.

The chief contribution of the present study of the mayflies of Piney River is similar to others which result from explorations into a poorly known faunistic area. Of necessity, considerable effort was expended in ascertaining what species are present in the area; however, the attempt to determine the spatial and ecological distribuiton of the several species was considered to be primary throughout the course of the study. Anticipated difficulty arose in that a study of the spatial and ecological distribution of the nymphs alone is hardly possible if one wishes to know with what species he is dealing; thus, it was necessary to obtain imagoes from the area. Some of the latter were collected in the conventional manner with the aid of a net; a few were attracted to a light-trap which was used in the late evening hours; and a number of specimens were reared from nymphs brought into the laboratory.

At the present time thirty-six species have been found in the area. Only twenty-five have been assigned specific names, and those without specific names have been designated as "species" and must await the correlations of the nymphal stages with the adult insects.

Previous Work on Virginia Mayflies

Little work has been done on the mayflies (of the state) of Virginia. Available published records indicate that only seventeen species have been reported prior to this work. The earliest record appeared in 1910 when Banks described *Heptagenia marginalis* from Glencarlyn and Great Falls, Fairfax County, Virginia. In 1914 he also described *Callibaetis pretiosus* from the latter locality.

Speith (1941) reported *Hexagenia munda marilandica* Traver from Fairfax County, and Surber (1951) listed ten additional species from the St. Mary's River in Augusta County. Those species which Surber lists are *Stenonema varium* Traver, *Stenonema fuscum* (Clemens), *Stenonema pul-*

[1] This paper is a portion of a thesis submitted to the faculty of the Samuel Miller Biological Laboratories, University of Virginia, in partial fulfillment for the degree of Master of Arts.

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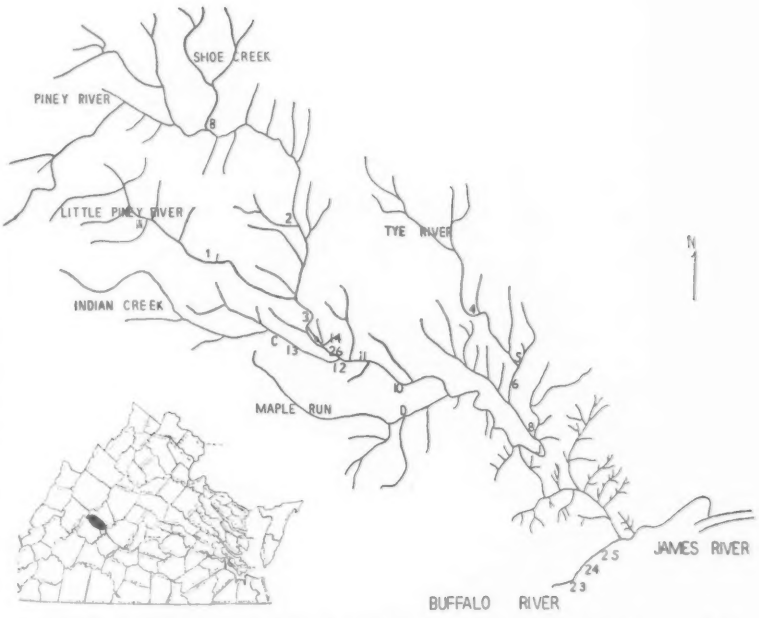

FIGURE 1.—Stations on the Piney, Tye, and Buffalo rivers from which mayflies were collected.

chellum (Walsh), *Stenonema heterotarsale* (McDunnough), *Isonychia sadleri* Traver, *Paraleptophlebia mollis* Eaton, *Ephemerella subvaria* McDunnough, *Baetis cingulatus* McDunnough, and *Pseudocloeon carolina* Banks.

The most recent work in which Virginia mayflies are treated is that of Burks (1953) in which he cites no specific localities but records the following species from the State: *Hexagenia atrocaudata* McDunnough, *Hexagenia bilineata* (Say), *Ephemerella dorothea* Needham, *Ephemerella funeralis* McDunnough, *Stenonema pudicum* (Hagen), and *Heptagenia marginalis* Banks.

Piney River

Piney River rises on the eastern slope of the Blue Ridge Mountains from spring and seepage areas, and flows eastward through portions of Nelson and Amherst counties. Much of the river is accessible by primary and secondary roads, but its upper reaches lie in rugged terrain which cannot be reached except on foot. It is a typical mountain stream in the Blue Ridge Province, and may be classified as a trout stream. Its headwaters lie at an elevation of approximately 3,100 feet, where small tributaries converge to form the river proper.

Along its course, the river, flowing over Precambian strata, is fed by several large tributaries of which the largest is the Little Piney River, the headwaters of which lie at an elevation of 3,250 feet.

Piney River drains some 70 square miles, traveling approximately seventeen miles before converging with the Tye River, and the latter subsequently with the Buffalo River. The confluence of these three streams a large tributary of the James River. The Piney, Tye, and Buffalo rivers drain a total of about 416 square miles. At Station 10 (see Figure 1) the rate of flow varied from approximately four to 64 cubic feet per second. The water level, in general, is highest in the spring, and is lowest in late summer and fall.

ANNOTATED LIST AND DISTRIBUTION OF MAYFLIES [3]

Family Ephemeridae. Nymphs of this family are burrowers and are found in mud and silt-bottomed pools along the shore of the stream. *Ephemera guttulata* Pictet was collected only at Station 1. No last instar nymphs were recorded, but adults were taken here in May. A single adult specimen of *Ephemera varia* Eaton was taken at Station 1 in May.

Another representative of this group, *Hexagenia* sp., was collected from two stations, 1 and 6, in July and August. Only five specimens were recorded, and none was in the last instar.

The subfamily Neoephemerinae was represented by one imago, *Neoephemera purpurea* (Traver), which emerged from a nymph brought into the laboratory in May.

[3] The author is aware of the recent familiar revision of the Ephemeroptera (George F. Edmunds, Jr. and Jay R. Traver—1954. An Outline of a Reclassification for the Ephemeroptera. *Ent. Soc. Wash.*, 56(5): 236-240.) but feels that the classification employed by Needham, Traver, and Hsu is adequate in this report.

Family Heptageniidae. Certain members of this family are among the most widely distributed mayflies in the area. Wherever there is flowing water and a flat surface to which they may cling, certain of these nymphs seem to abound.

Stenonema pudicum (Hagen) was collected at every station visited except 11, 14, and 24. Last instar nymphs were taken from stations 1 and 4 in April and May.

Stenonema heterotarsale (McDunnough) was not so widely distributed in the stream, being found at stations 1, 2, 3, 4, 6, A, B, C, D, and J. At all stations it was found in relatively small numbers. There are no records of nymphs in the last instar, but imagoes were taken at stations 1 and 4 in May.

Heptagenia juno McDunnough was collected in relatively large numbers from stations 1, 2, 3, 6, 8, 13, and B. It seems to be restricted to the riffle areas where large rocks are present. Last instar nymphs were collected in July, and adult specimens were taken at Station 1 in September.

Rhithrogena amica Traver was represented by ten imagoes taken at Station 1 in May.

Rhithrogena anomala McDunnough was found only at Station 1. Nymphs and adults were recorded from this station in late April.

Rhithrogena exilis Traver was collected in small numbers from stations 1, 2, 3, A, and B, all of which lie above the 600-foot contour level. Last instar nymphs were found in July, and no adults were encountered.

Epeorus humeralis Morgan seems to be one of the most abundant species in Piney River having been collected at every station except 10, 11, 12, 14, 23, 26, B, and D. Nymphs in the last instar were collected in August and September, and adults were taken from Station 1 in September.

Epeorus pleuralis (Banks) was taken in very small numbers from stations 1, 2, 3, 4, 6, A, B, C, D, and J. Several adult specimens were reared from nymphs brought into the laboratory in April. It occurs in a habitat similar to that of *Epeorus humeralis*.

Family Baetidae. This family is represented by the largest number of species, and certain members are distributed along the entire course of the river except in contaminated areas.

Ameletus sp. was taken only from stations 1 and 4. Fifteen specimens were gathered during the survey and no record can be given for last instar nymphs or adults.

Isonychia sadleri Traver was collected from every station except 11 and 14, and appears to be the most ubiquitous species encountered during the period of this survey. Last instar nymphs were taken in May, July, August, and October. Adults were recorded from Station 1 in May.

Leptophlebia sp. occurred only at stations C and D, both located on small tributaries of Piney River. This species seems to prefer the more sluggish reaches of the stream where grasses of the shore-line hang into the water.

Paraleptophlebia adoptiva McDunnough is represented by several adult specimens taken from Station 1 in April.

Paraleptophlebia guttata McDunnough was collected in rather large numbers from stations 2, 3, 13, A, B, and C. It was abundant in the broad shallow riffle areas at these stations. Nymphs in the last instar were taken in March, and adults of this species were recorded from Station 1 in May and September.

A number of adults of an undescribed species of *Paraleptophlebia* were collected from Station A in March.

Habrophlebiodes americana (Banks) was collected at stations 3 and J in May. None of the nymphs were in the last instar.

Habrophlebia vibrans Needham is represented by several nymphs taken from Station 1 in May; last instar nymphs were not encountered.

Baetisca carolina Traver was collected in very small numbers from three stations 2, 3, and B. Nymphs in the last instar were found in May.

The genus *Ephemerella* is represented in the area by a larger number of species than any other genus. As a group these nymphs show a large range of tolerance, but they seem to prefer gravel-bottomed portions of the stream.

Ephemerella cornutella McDunnough was collected at all stations except 11, 13, 14, 26, A, C, and D. A relatively large number of specimens were taken and last instar nymphs were found in July.

Ephemerella deficiens Morgan shows a slightly broader tolerance to stream conditions than the other species of the genus and was collected from all but stations 14, 26, C, and D. No imagoes were taken although last instar nymphs were collected in August.

Ephemerella dorothea Needham is represented by several imagoes which were reared in the laboratory from nymphs collected from Station 4 in April.

Ephemerella minimella McDunnough is not so widely distributed in Piney River as are *E. cornutella* or *E. deficiens*. It occurs in varying numbers in the shallow riffles where there is an accumulation of gravel. Nymphs were taken from stations 1, 2, 3, 4, 5, 6, 8, 25, A, B, and J. No adults of this species have been observed, although last instar nymphs were collected in May.

Ephemerella serratoides McDunnough was taken in small numbers at all stations except 10, 13, 14, 25, 26, C, and D. Nymphs in the last instar were recorded in August. No adults were observed.

Ephemerella tuberculata Morgan was collected at stations 4, 24, and J. At Station 4, where they were most abundant, a luxuriant growth of *Podostemum* occurs on the rocks. Neither last instar nymphs nor adults were observed.

Ephemerella wayah Traver was collected in relatively small numbers and appears to be somewhat uncommon in Piney River. In the lower portions of the Tye and Buffalo rivers, however, it appears to be more abundant. It was collected from stations 3, 4, 5, 6, 8, 12, 13, 25, and J. Neither last instar nymphs nor adults were recorded.

Ephemerella sp. was taken from stations 2 and 4 where there is a large accumulation of gravel in the river bed. While nymphs in the more advanced instars were found in April, neither last instar nymphs nor adults are known.

The following three species also inhabit gravel-bottomed areas.

Tricorythodes sp. was taken in very small numbers from stations 1 and 6 in July. Neither last instar nymphs nor adults have been collected.

Caenis sp. shows a slightly wider distribution than *Tricorythodes* sp., having been taken in small numbers from stations 1, 2, 3, 6, and B. There are no records of last instar nymphs or adults.

Baetis vagans McDunnough is generally distributed in the area investigated, occurring in small numbers at stations 1, 2, 3, 4, 5, 6, 8, 10, 12, 13, 25, A, and B. Nymphs in the last instar were taken in July and October, and several adults were reared in the laboratory in April from nymphs collected at Station 4.

The remaining members of the family Baetidae show a broad tolerance in relation to habitats. Members of the genus *Pseudocloeon* inhabit the rapid waters of cascading areas and also the slow currents of silt and gravel-bottomed pools.

Pseudocloeon carolina Banks was collected from stations 1, 2, 3, 4, 5, 6, 8, 10, 12, 13, 25, A, B, and J. Nymphs in the last instar were taken in August. No adults of this species were observed.

Pseudocloeon dubium (Walsh) was collected in small numbers from stations 1, 2, 3, 4, 5, 6, 8, 10, 12, 13, 24, A, and B. It seems to prefer riffle areas where the water is not flowing too rapidly. Last instar nymphs were taken in October.

Pseudocloeon sp. was not so widely distributed in the area and even at the stations where it was encountered, it was not common. Specimens were taken from stations 1, 2, 3, 4, 5, 6, 10, 12, 13, 23, and A. Nymphs in the last instar were taken in July and August.

Centroptilum simile McDunnough was represented by six specimens collected at Station 1 in May. No nymphs of this genus were observed during the course of this survey.

The work which has been done in this survey indicated that there is a wide range of tolerance exhibited by the mayflies, as a group, to the varying ecological conditions in the Piney, Tye, and Buffalo rivers. Certain species such as *Epeorus humeralis*, *Isonychia sadleri*, and *Stenonema pudicum* occur along the entire course of the streams. Other species, such as *Stenonema heterotarsale* and *Leptophlebia* sp. are much more restricted in their distribution. There is considerable evidence that some of the species are able to survive in areas of the stream where there is a continuous deposition of finely divided particulate matter.

SUMMARY

1. Previous records of Virginia mayflies are few, and the records of only 17 species occurring in the State have been reported. Twenty-three specific names may now be added to the Virginia list.

2. A general description of the Piney River area is presented.

3. Among the 6,600 specimens collected during the course of this survey, thirty-six species have been recognized, and their distribution in the area indicated.

ACKNOWLEDGMENTS

I wish to express my sincere thanks to Messrs. H. H. Hobbs, Jr. and B. F. D. Runk under whose guidance this survey was made.

To Professor Lewis Berner, Department of Biology, University of Florida, my deepest gratitude for verification of the classification of the specimens.

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News and Notes

MESSAGE FROM THE PRESIDENT

The 1956 Annual Meeting of the Virginia Academy of Science will be held in Richmond, May 10-12, under sponsorship of the Richmond Area University Center. Indications are that the Local Arrangements Committee will provide us with an exceptionally well organized meeting. The time is fast approaching when we need to give some thought to assembling the program for this meeting.

Our Academy is no stronger than the programs presented within the several Sections. The number of scientists in Virginia, as well as the number of their scientific contributions, are both considerably greater now than was the case a few years back. These facts have not always been reflected in our Academy Sectional Programs. We are asking this year that the officers and members of each Section make a special effort to arange an outstanding program——certainly in quality, and also in quantity if at all possible. The Academy in its earlier days, but with fewer Sections, usually had a full one and one-half days program in practically all Sections. It would be stimulating to the Academy and its members and, I believe, a boon to science in Virginia, if programs of this length——composed of worthy contribtuions——could be presented by most Sections now.

The officers and members of each Section will have better ideas on how to achieve good programs than can be given by one outside the Section. Liberty might be taken, however. to make a few general suggestions: (1) Many of the stronger, "professionally entrenched," members present results at national meetings where more professional recognition is available. These men might be urged, also, to make reports at our Academy meetings for the benefit of science in Virginia, for the good of the Academy, and for the inspiration of our graduate students and younger scientists; (2) if (a) institutional staff members would insist that all their students receiving Master's or Doctor's degrees present results, and (b) if older men in research organizations would insist that younger workers report to the Academy on their research——many worthwhile papers would eventuate and also these younger people would be brought into contact and work with our Academy; and, (3) we, the collective scientists of the state, belong to and *are* the Virginia Academy of Science. Shortcomings of the Academy are really our own deficiencies. One thing which we all can and should do to strengthen our programs, and hence the Academy, is to see to it that all worthy pieces of research by Academy members are reported upon at the Annual Meeting.

To present the strongest possible program at each annual meeting would advance the Academy, and aid its stated purpose of encouraging scientific research——while also arousing interest in science among the people of Virginia. May we each work for an outstanding Academy program in 1956!

WALTER S. FLORY, JR., *President*

JUNIOR ACADEMY RECEIVES GRANT FROM PHILIP MORRIS, INC.

Philip Morris, Inc., has recently made a grant of $750 to the Virginia Junior Academy to be used in encouraging more high school students with aptitudes for science and engineering to choose these fields for their careers. Dr. Robert N. DuPuis, vice-president and director of research of this company, presented the grant to Mrs. B. G. Heatwole, Chairman of the Junior Academy Committee, and to Dr. Walter S. Flory, president of the Virginia Academy of Science. A portion of the grant will be used for prizes at the annual meeting in Richmond for outstanding exhibits by "junior scientists" in each of four categories, chemistry, biology, physics, and other sciences such as mathematics and astronomy. Other portions are to be used for promotional work for the Junior Academy and in the establishment of a fund for use by high school students for procuring equipment for their exhibits. Upon accepting the grant from Dr. DuPuis, Dr. Flory stated, "If industrial firms will help us as Philip Morris is doing, the Virginia Academy of Science and other local scientific organizations eventually can do much toward solving on a state level the serious scientific manpower shortage."

SECTION NEWS

AGRICULTURAL SCIENCE SECTION

Dr. R. F. Miller from Madison, Wisconsin, has recently joined the Virginia Agricultural Experiment Station staff as Associate Nutritionist in the Department of Biochemistry and Nutrition. Dr. Miller received the Ph.D. degree in biochemistry at the University of Wisconsin. He received the B.S. degree at Northern Illinois College. Dr. Miller's Ph.D. thesis research problem dealt with the effects of sodium fluoride supplementation of dairy cattle rations and with fundamental studies aimed at elucidating the mechanism of fluoride storage and removal from bone structures in animals. Dr. Miller will conduct studies at Blacksburg dealing with the effects of minor element imbalances in animals.

Two new research projects have been initiated in the Agricultural Engineering Department of the Virginia Agricultural Experiment Station. One of these is "Structural Stability of Farm Buildings Under Accelerated Cycles of Loading". The objective of this new project is to determine the structural stability of full scale farm building sections, joints and other components and develop criteria for balanced building designs. Leader for the project is Homer T. Hurst, who joined the Agricultural Engineering Department staff earlier this year.

"Processing and Handling Virginia Tobacco for Marketing" is the title of the other project under the leadership of Dr. V. H. Baker. The first phases of this study will deal with the determination of the equilibrium moisture content of various types, varieties and grades of tobacco under normal conditions of temperature and relative humidities encountered in processing and marketing. The study will then be directed to the develop-

ment of methods of determining and controlling moisture in tobacco during processing procedures from harvesting through marketing.

J. P. H. Mason was appointed Assistant Professor of Agricultural Engineering effective September 1. Professor Mason obtained his B.S. degree in Agricultural Engineering, his B.S. in Mechanical Engineering, and has completed the requirements for a M.S. degree in Agricultural Engineering at Virginia Polytechnic Institute. He will devote two-thirds of his time to teaching and one-third to research.

The Virginia Section, American Society of Agricultural Engineers, elected the following members of the Virginia Polytechnic Institute faculty to the following offices for 1955-56 at its meeting in Roanoke on November 5: Chairman, E. T. Swink, Head, Agricultural Engineering Department; Vice-Chairman (one of three), Dr. V. H. Baker, Agricultural Engineer; and Secretary, A. J. Lambert, Associate Extension Agricultural Engineer.

Dr. W. L. Gibson, Jr., Dr. T. E. Tramel, Dr. R. J. Krueger, Dr. Carl W. Allen, and Mr. R. Lee Chambliss, Jr., of the Agricultural Economics Department, Virginia Polytechnic Institute, attended the annual meeting of the American Farm Economics Association, at Michigan State University in August.

Dr. T. E. Tramel was appointed professor of Agricultural Economics at Virginia Polytechnic Institute, July 1, 1955. Dr. Tramel is a native of Mississippi and received his Ph.D. degree in June 1954 from Iowa State College. He had been teaching farm management at Mississippi State for several years. At Virginia Polytechnic Institute Dr. Tramel will be engaged primarily in research. His first study will be in the area of an economic evaluation of forages.

Mr. George T. Blume was appointed Assistant Extension Sociologist with the Virginia Agricultural Extension Service, Virginia Polytechnic Institute, on September 1, 1955. Mr. Blume holds a B.S. from Virginia Polytechnic Institute, an M.S. from Louisiana State University, and has been doing graduate work at the University of Missouri for the past two years.

Carl J. Arnold was appointed Associate Agricultural Economist with the Agricultural Extension Service, Virginia Polytechnic Institute, September 15, 1955. Mr. Arnold has an M.S. degree in Dairy Science from Virginia Polytechnic Institute and has been doing graduate work on his Ph.D. in Agricultural Economics at Michigan State University for the past two years. Mr. Arnold will be doing Extension work in the area of dairy marketing.

C. I. Rich, Agronomy Department of Virginia Polytechnic Institute, was appointed to the committee on "Soil Mineral Analysis Methods" for the Soil Science Society of America. This is a new committee with the first assignment to make recommendations for clay mineral analysis methods.

Lee W. Herrick, Poultry Department, Virginia Polytechnic Institute, was granted leave the first of August to carry on poultry work in Pakistan under the Foreign Operations Administration of the U. S. Government.

Dr. Everett L. Wisman assumed half-time duties with the Poultry Hus-

bandry Department, Virginia Polytechnic Institute, September 1. He had been giving full-time to Biochemistry-Nutrition.

Denver D. Bragg, James H. Bywaters, Clayton E. Holmes, and Harry L. Moore, all of the Poultry Department, Virginia Polytechnic Institute, attended the 44th Annual Meeting of the Poultry Science Association at Michigan State University, East Lansing, August 9-12.

Yong Soon Bai of Seoul, Korea, was awarded the Agronomy Club—National Plant Food Institute Scholarship for the college year 1955-56. Prior to entering Virginia Polytechnic Institute as a freshman this September, Mr. Bai attended high school in Salinas, California, for a year. He plans to return to Korea after completing undergraduate and graduate work in the United States.

E. G. Thompson, Associate Professor of Agricultural Education, has been granted an extension of his leave of absence to continue graduate work leading to the Doctor's degree at Cornell.

B. C. Bass, Associate Professor of Agricultural Education, received the Ed.B. degree at Pennsylvania State University in June, 1956, and returned to his work at Virginia Polytechnic Institute in the Department of Vocational Education.

Miss Martha Creighton, Professor of Home Economics Education at Virginia Polytechnic Institute, was one of two representatives of the American Vocational Association at the White House Conference on Education.

H. W. Sanders, Head of Vocational Education at Virginia Polytechnic Institute, with the assistance of staff members is completing a follow-up study of all students who have taken Vocational Agriculture in high schools in Virginia since 1918. This is the most comprehensive study of this nature that has ever been completed.

Nearing completion is a study of the home project in homemaking education in a selected group of Virginia schools. This study has been made by the Home Economics Education Department of Virginia Polytechnic Institute in cooperation with the Virginia Department of Public Instruction. The purpose of the study was to determine what practices home economics teachers follow in guiding pupils in their home project programs. Nineteen schools were selected at which interviews were held with the principal, the home economics teacher, five home economics pupils and five mothers. On completion, the results will be distributed to school administrators and home economics teachers.

Dr. Jacob H. Tinga has been appointed Associate Professor of Horticulture at Virginia Polytechnic Institute. He is filling the vacancy in the ornamental section of the department which was left by H. Van de Werken, who resigned to become general manager of the Boxwood Nurseries of Mocksville, North Carolina. Dr. Tinga is particularly well qualified to discharge the responsibilities which are being assigned to him. He is the son of a nurseryman located at Wilmington, North Carolina. He secured his B.S. degree in Horticulture from North Carolina State College in 1942, and his Ph.D. degree from Cornell University in September, 1955. The program in ornamental horticulture at Virginia Polytechnic Institute will

be changed somewhat as a result of Dr. Tinga's joining the staff. He will be responsible for the Virginia Polytechnic Institute Arboretum and the research program with plant materials used for landscaping. He will also teach the courses in floriculture, nursery management and plant materials.

Dr. R. D. Krebs joined the Agronomy Department, Virginia Polytechnic Institute, September 1 to assist Dr. C. I. Rich in his colloidal clay studies. Dr. Krebs received his Ph.D. degree from Rutgers University in the field of clay colloids.

Dr. Lincoln H. Taylor joined the Agronomy Department, Virginia Polytechnic Institute, effective October 1, as a forage crop breeder. He will devote his primary interest to breeding and development of new and improved varieties of orchard grass. Dr. Taylor is a native of South Dakota and received his Ph.D. degree in forage crop breeding at Iowa State College. He has recently been a member of the Agronomy Department at the University of Maine.

Dr. R. K. Stivers, who has been a member of the Agronomy Department, Virginia Polytechnic Institute, for several years and engaged in soil fertility research, has accepted a position at Purdue University in the Agronomy Department, effective November 1. Mr. Wybe Kroontje will fill the position vacated by Dr. Stivers. Mr. Kroontje is scheduled to receive his Ph.D. degree in soil fertility from the University of Nebraska in January and will report February 1. He will engage in soil fertility research.

The Department of Dairy Husbandry at Virginia Polytechnic Institute is now known as the Department of Dairy Science. This change became effective in August. The new name more adequately describes the duties and functions of the department. Research, instruction and extension in dairy production and dairy manufacturing are conducted by the department.

New appointments in the Department of Dairy Science include P. M. Large and W. S. Griffith. Professor Large teaches dairy manufacturing courses. He is a graduate of Virginia Polytechnic Institute and received his M.S. degree from Ohio State University. W. S. Griffith conducts dairy extension work dealing with feeding, management and testing of dairy cattle. He received his B.S. degree from Pennsylvania State and M.S. degree from Louisiana State University.

John B. Lindamood reecived his M.S. degree in Dairy Husbandry—Dairy Manufacturing option—in June 1955, at Virginia Polytechnic Institute.

Professor P. M. Reaves was elected chairman of the Agricultural Faculty at Virginia Polytechnic Institute at its recent meeting. Dr. W. A. Hardison was elected a member of the graduate committee of the Agricultural Faculty.

Dr. G. C. Graf appeared on a panel discussion, entitled "An Integrated Approach to Pasture Evaluation", at the Southern Regional Pasture and Forage Crop Improvement Conference in Knoxville, Tennessee, on June

14-16. A paper on "What are we learning from the study of grazing animal behavior and from palatability studies?" was also presented by Dr. W. A. Hardison.

Professor W. D. Saunders, who has been retired from the Virginia Polytechnic Institute Department of Dairy Science for many years, died October 17, 1955. Professor Saunders was known throughout the U. S. for his work in connection with the manufacture of cheese.

Dr. Forman T. McLean retired from the position of Plant Breeder at the Virginia Truck Experiment Station on July 1, 1955. He is now a member of the faculty of the Norfolk Division of the College of William and Mary–Virginia Polytechnic Institute.

Dr. Franklin B. Stewart joined the research staff of the Virginia Truck Experiment Station on August 1, 1955, as Associate Soils Technologist. He received his graduate training at the University of Maryland.

Mr. M. H. Gallatin of the Agricultural Research Service, Soil and Water Conservation Research Branch, U. S. D. A., established headquarters at the Virginia Truck Experiment Station in May 1955, to begin cooperative studies dealing with salinity problems in irrigation for the middle Atlantic area.

Dr. Edgar Merrow Raffensperger was appointed as assistant entomologist in the Virginia Agricultural Experiment Station September 1, 1955. He holds B.S. and M.S. degrees from Pennsylvania State University and the Ph.D. from the University of Wisconsin. His employment was in connection with a new research program on insects affecting livestock.

The following entomologists from Virginia Polytechnic Institute attended the meetings of the Entomological Society of America in Cincinnati, Ohio, on November 28 through December 1: Dr. T. B. Davich, Dr. C. H. Hill, Mr. A. M. Woodside, Mr. C. B. Dominick, Dr. M. L. Bobb, Dr. E. C. Turner, Jr., Dr. A. A. Muka, Dr. E M Raffensperger, Dr J O Rowell, Mr. A. P. Morris, and Dr. J. M. Grayson. The following graduate students also attended this meeting: Mr. W. T. Keeton, Mr. P. K. Harein, and Mr. A. S. Tombes.

Mr. Roy Stout has assumed his duties as cooperative agent of the Agricultural Research Service and the Virginia Agricultural Experiment Station, (Agricultural Economics Department). Mr. Stout is a native of West Virginia and holds an M.S. degree in Agricultural Economics from Virginia Polytechnic Institute. He will coordinate the activities of the Southern Regional Livestock Marketing Research Committee.

REORGANIZATION OF STATE DEPARTMENT OF AGRICULTURE COMPLETED

The Virginia State Department of Agriculture has made what is described as a major move in the continuing effort to keep its law enforcement work abreast of the advances made in the industries it regulates.

The Division of Dairy and Foods has been abolished, and its field inspection work on milk, food and feed consolidated with the laboratory

work on the same commodities now done by other divisions. This puts the field inspection work and the laboratory work on each commodity under the same administrative head, instead of having the field inspectors working out of one division and the laboratory which analyzes their samples working out of another.

The new arrangement will enable the Department to give more emphasis to the scientific end of law enforcement, just as industry is giving more and more importance to science.

Norman L. Franklin, whose job as director of Dairy and Foods Division was abolished, took up new duties as chief of the Department's regulatory work on butterfat testing and auditing of records in Virginia dairy plants.

Under the reorganization, the Division of Animal Industry, which already has responsibility for the health of the dairy cow and for laboratory work on milk samples, absorbed enforcement of Department laws covering sanitation of the dairy farm, the dairy plant and milk.

This puts all of the Department's dairy work under Dr. W. L. Bendix, State Veterinarian, as head of the new Division of Animal and Dairy Industries.

C. F. Hangar, who now heads dairy law enforcement in the Division of Dairy and Foods, will continue to head the field enforcement under Dr. Bendix. Franklin will also work under Dr. Bendix.

Sanitation of human foods and livestock feeds has been transferred to the Division of Chemistry, which already includes the food and feed laboratories.

Rodney C. Berry, State Chemistry, heads the new Division of Chemistry and Foods. Herbert McLeod, Jr., will continue to direct enforcement of food laws and C. F. Bruce will continue as head of field enforcement of the feed laws, under the overall supervision of Mr. Berry.

The Department's two-egg law enforcement men, S. T. Vaughan and H. A. DeLong, have been transferred to the Poultry and Egg Section, Division of Markets, under Hollis S. Shomo.

—CARL W. ALLEN, *Virginia Polytechnic Institute*

BACTERIOLOGY SECTION

The fall meeting of the Bacteriology Section of the Virginia Academy of Science and the Virginia Branch of the Society of American Bacteriologists was held jointly at the Medical College of Virginia in Richmond on Saturday, December 10.

Dr. E. Clifford Nelson, Associate Professor of Parasitology, Department of Microbiology, Medical College of Virginia, Richmond, spent the period of September 21 to November 22, 1955, in Central America. Practical experience in parasitology and tropical medicine was obtained on a fellowship provided from a grant made to Louisiana State University by the China Medical Board of New York and administered by Dr. W. W. Frye and Dr. H. E. Meleny. Programs of study were followed in Costa Rica, El Salvador, and Guatemala.

—J. DOUGLAS REID, *University of Virginia*

BIOLOGY SECTION

Mr. W. Ralph Singleton has succeeded Orland E. White as Director of the Blandy Experimental Farm, University of Virginia. He has also been appointed Miller Professor in the Department of Biology at Charlottesville. The plant collection at Blandy Farm, Boyce, has been named "The Orland E. White Arboretum" and Mr. Walter S. Flory has been appointed the Curator.

Mr. Horton Hobbs has recently been promoted from Associate Professor to Professor of Biology, University of Virginia.

Mr. James Irvine and Mr. Edward Lautenschlager have been appointed Instructors in the Department of Biology, University of Virginia.

Mr. Orland E. White who was retired from the faculty of the University of Virginia in June 1955, is now teaching at Sweet Briar College.

Mr. Philip E. Graef has accepted a position in the Department of Biology at East Carolina College, Greenville, North Carolina. Mr. Graef received the doctorate from the University of Virginia in June 1955. His research interests are in the fields of Plant Morphogenesis and Embryogenesis.

Mr. Jesse Thompson was awarded the doctorate degree in June 1955 by the University of Virginia and is now Assistant Professor of Biology at Hollins College. Mr. Thompson's researches concern the morphology of *Tetrahymena* and related protozoa.

Julian Cagle, formerly of the Department of Biology at Hollins is now at Princeton continuing graduate study in zoology. Miss Helen Churchill has been promoted to Associate Professor of Biology at Hollins.

Dr. John G. Mahan, professor of Biology at Lynchburg College, is spending two quarters of a sabbatical leave at Virginia Polytechnic Institute, where he is doing work in Entomology.

Dr. Paul J. Osborne has accepted a place on the Biology staff at Lynchburg College, with the rank of Associate Professor. Dr. Osborne did his bachelor's and master's work at the University of Virginia, and received the doctor's degree at the University of Florida in August.

Mrs. Peggy Watts, formerly on the Randolph-Macon Woman's College Biology staff, is assisting in the Lynchburg College Department of Biology during Dr. Mahan's leave. Mrs. Watts did her master's work at Syracuse University.

A new Science Building will be ready for occupancy at Emory and Henry College in February 1956. The building is 60 feet x 150 feet, with three stories and will house engineering and photography on the first floor, biology on the second, and chemistry on the third. The biology quarters consist of two lecture rooms, general laboratory, physiology and anatomy laboratory, and a laboratory for bacteriology and microtechniques. An advanced botany laboratory and herbarium are also included. Two spacious offices equipped for research will be headquarters for the teaching staff.

In a revision of the science requirement of the curriculum at Bridgewater College designed to strengthen the science offering in the program of general education, two new courses have been developed. These are

designated as Natural Science 1-2, General Biological Science, and Natural Science 3-4, General Physical Science. Both courses will run as full year courses, meeting three times a week in the classroom and once a week in laboratory. The course in General Biological Science is being given by Harry G. M. Jopson, Professor of Biology, and Miss Elizabeth Ann League, Assistant Professor. Prof. W. Donald Clague is teaching General Physical Science. Other offerings in the Division are continuing as before.

It is with deep regret that we note the passing of Mr. George C. Mason on May 10, 1955. Mr. Mason was a member of the Biology Section and active in Academy affairs. He was for many years Director of the Mariners Museum and served the Academy as a member of its Museum Committee. The Academy will greatly feel his loss.

—ROBERT T. BRUMFIELD, *Longwood College*

CHEMISTRY SECTION

Dr. Lucius J. Desha, formerly Professor and Head of the Department of Chemistry at Washington and Lee University, has retired as Professor Emeritus. His association with W. and L. dates from 1920, and he has long been recognized as one of the outstanding educators in the state. His text, *Organic Chemistry*, which recently went through a second edition, has been regarded for many years as a standard in this field. Dr. Desha's duties will be taken over by Dr. E. S. Gilreath, who has been made Professor of Chemistry and Head of the Department. Dr. Gilreath is also the author of a recent text book on Qualitative Analysis (McGraw-Hill), which has been widely adopted.

W. J. Watt, who will receive his doctorate from Cornell University in January has joined the staff of Washington and Lee as an Assistant Professor. Associate Professor J. H. Wise served again last summer as a research participant, working on high resolution spectroscopy, at the Oak Ridge National Laboratory. The Department has also received a grant of six thousand dollars from the National Science Foundation for the support of research entitled "Resolution of Optically Active Compounds through the Carbonyl Group". This work will be under the direction of Assistant Professor J. K. Shillington.

Dr. Ashley Robey reports from Roanoke College that the number of students enrolled in chemistry is up 41 per cent over that of last year. It would be interesting to know if a similar trend has been observed in other institutions in the state. To help cope with the increase at Roanoke, Mrs. Norma B. Moran has been added to the staff as a full time Instructor. She had formerly served on a part time basis.

Hampden-Sydney College has added a third man, Samuel M. Graham, to its chemistry staff. Mr. Graham is a native of Pulaski, Virginia, and received his bachelor's and master's degrees from Virginia Polytechnic Institute. He has had considerable industrial experience, having been associated with the Sherwin-Williams Company and with the duPont Company, both in Richmond and in Louisville, Kentucky. He is scheduled to

receive his doctorate in organic chemistry from Catholic University next year.

Professor Harriett H. Fillinger of Hollins College is serving a two-year appointment on a national committee to study the Teaching of Chemistry for the Division of Chemical Education of the American Chemical Society. She has also been reappointed for a second year as the representative of the Virginia Blue Ridge Section of the A. C. S. to the Division of Chemical Education. One of the problems being studied by the Chemical Education Committee concerns the serious shortage of chemistry teachers, and Professor Fillinger would be glad to receive suggestions for presentation to the committee from anyone interested in this problem.

James Burleigh Lucas, 67, Professor of Chemistry at Virginia Polytechnic Institute, died at his Blacksburg home on October 2. He was a native of Montgomery County and was educated at Virginia Polytechnic Institute and at the University of Illinois. He was an outstanding teacher and educator in the field of organic chemistry. His research activities were centered in this field and that of the rare earths. Professor Lucas joined the Virginia Polytechnic Institute staff in 1916. Aside from his teaching duties, Professor Lucas took an active part in all worthwhile community enterprises. He was a prominent Methodist, a Mason, and for some years a member of the Blacksburg Lions Club. At one time he served as Superintendent of Schools of Montgomery County. His wife, Mrs. Frangie Davis Lucas, was for some years prior to her death in 1949 an Instructor in the Department of Physics at Virginia Polytechnic Institute.

He is survived by four daughters, all V. P. I. graduates: Mrs. Oswald Joerg, Evansville, Indiana; Mrs. H. E. Spangler, Harrisonburg, Va.; Mrs. Claude Pyle, White Sands Proving Grounds, N. M.; and Mrs. C. H. Garrette, Jr., Richmond, Va.

Virginia chemists were well represented on the program of the Southeastern Regional Meeting of the American Chemical Society held at Columbia, South Carolina, November 3-5. Among those presenting papers were Jane Bell Gladding and William E. Trout, Jr. from the Richmond Professional Institute and the University of Richmond, respectively; J. S. Belew, Edward E. Bowden, Donald R. Campbell, James W. Cole, T. I. Crowell, Robert E. Cunningham, Carl D. Lunsford, Robert E. Lutz, A. L. McCloskey, Gilbert T. Perkins, and F. W. Young from the University of Virginia; Alexej Borkovec, Robert C. Krug, Frank A. Vingiello, and Teh Fu Yen from Virginia Polytechnic Institute; W. D. Goode, Jr., R. D. Whitaker and J. H. Wise from Washington and Lee; and Carl J. Likes from the Virginia Institute for Scientific Research. Dr. William P. Boyer, Director of Research for the Virginia-Carolina Chemical Corp., was one of the prin-

cipal speakers. His topic was "The Chemical Industry in the South Atlantic States."

Dr. J. W. Watson, Head of the Chemistry Department at Virginia Polytechnic Institute has announced the following changes in the chemistry staff. Dr. F. B. Clough resigned to accept a teaching position at Stevens Institute of Technology. Additions are M. L. Spangler as Instructor and Jack Vanderryn as Assistant Professor. Mr. Spangler is a graduate of Bridgewater College and received his Master's degree from Virginia Polytechnic Institute. Dr. Vanderryn did both his undergraduate and graduate work at Lehigh University.

The following members of the Virginia Polytechnic Institute staff have received research grant for the current session: Dr. Ralph G. Steinhardt. Jr., a grant from the American Academy of Arts and Sciences to support his studies on X-ray excitation potentials; Dr. P. C. Scherer an Army Ordnance contract for "Dielectric Dispersion Studies of Solutions of High Polymers." Grants from the Research Corporation have been made to Drs. D. W. Levi, L. K. Brice, and F. A. Vingiello. Dr. Brice's work will be concerned with "A Kinetic Study of Some Aromatic Cyclodehydration Reactions", and that of Dr. Vingiello with the "Synthesis of Hydrocarbons". Dr. Vingiello also has an Army Ordnance contract which has been renewed for a second year.

W. L. McPherson, Assistant Professor of Chemistry at Virginia Polytechnic Institute, spent the summer at the Oak Ridge National Laboratory working as a research participant with the Radiochemical and Activation Analysis Groups of the Analytical Division.

Two postdoctoral fellows have joined the staff of the Pratt Trace Analysis Laboratory of the University of Virginia. They are Dr. Riccardo Monacelli of the University of Rome and Dr. Hisashi Tanaka, a graduate of Kyoto University.

Dr. John H. Yoe, Chairman of the Chemistry Department of the University of Virginia, presided at a symposium on trace analysis held in New York, November 2-4. Dr. Yoe also attended a two-day conference October 13 and 14 at Johns Hopkins University on the education of chemists. Other Virginia educators attending this conference were: L. J. Desha (Washington and Lee), J. M. Frederickson (Hampden-Sydney), H. H. Garretson (Lynchburg College), W. G. Guy (William and Mary), R. C. Krug (Virginia Polytechnic Institute) and W. E. Trout, Jr. (University of Richmond).

The School of Medicine of the University of Virginia sponsored a conference in September of the pre-medical committees of the various Virginia colleges to discuss mutual problems associated with pre-medical educational program. Colleges represented at the meeting included Emory and Henry, Hampden-Sydney, Roanoke, Randolph-Macon (Ashland), the University of Richmond, Virginia Military Institute, Virginia Polytechnic Institute, Washington and Lee, and William and Mary.

The Richmond Chapter of the American Chemical Society has awarded a grant to Dr. J. Stanton Pierce of the University of Richmond for the

synthesis of tetrazolium salts for use in cancer research. Senior students, Lawrence D. Hanbeck and Eugene M. Newman, will work with Dr. Pierce on the problem, and the compounds which are synthesized will be forwarded to Dr. George Z. Williams, Head of Clinical Pathology, National Institute of Health at Bethesda, Maryland, for screening.

Dr. J. C. Forbes and Dr. Lynn D. Abbott, Jr., represented the Medical College of Virginia at a symposium on "The Role of Some of the Newer Vitamins in Human Metabolism and Nutrition" held at Vanderbilt University in October. Dr. Abbott also served as chairman of the afternoon session of the annual meeting of the Southeastern Section of the Society of Experimental Biology and Medicine held at Emory University on November 18. At the same meeting he presented a paper——"Porphrin Synthesis by Avian Erythrocytes *In Vitro* and the Inhibitory Effects of Certain Substituted Benzimidazoles."

Mrs. Jane Bell Gladding, Richmond Professional Institute, has been promoted to Assistant Professor of Chemistry. Mrs. Gladding received her Master's degree from the University of Richmond last August and presented some of the results of her research work (with Dr. William E. Trout, University of Richmond) at the Southeastern Meeting of the American Chemical Society in Columbia, South Carolina. Dr. Mary E. Kapp, Head of the Chemistry Department at Richmond Professional Institute also attended the Southeastern Meeting.

E. S. Harlow, Coordinator of Research at the American Tobacco Company, attended the White House Conference on Education in Washington, D. C., November 28 through December 1 as one of the delegates from the State of Virginia. B. M. Bruner, Head of the Technical Information Division at ATC, was elected Virginia vice-president of the Southern Association of Science and Industry at the recent Trustees' meeting in Roanoke.

J. Marshall Moseley presented a paper "Protein Changes in Tobacco During Curing and Pectin Methylesterase of Cured Tobacco", at the annual Tobacco Chemists' Research Conference in Raleigh, October 6-7. The work presented in the paper was carried out jointly by the American Tobacco Company and the Virginia Institute for Scientific Research. A large number of papers were also presented at the same meeting by representatives from the research laboratory of Philip Morris Co., Ltd., Richmond.

Recent additions to the research staff of the American Tobacco Company are Dorothy A. Douglass and Barbara V. Mitchell (Longwood College), Marian N. Jones (Notre Dame of Maryland), and John G. Brooks (Virginia Polytechnic Institute); also Drs. Lovell J. Dowey (Michigan State), William Stepka (University of California) and Eugene Glock (Pennsylavnia State).

"The Golden Leaf", a new film in technicolor, has recently been produced by the American Tobacco Company. The film is a documentary one on the production and processing of tobacco from the seed bed to the cigarete. Running time is 26 minutes, and it is available on request from B. M. Bruner of the Research Laboratory.

Dr. Hartwell F. Calcote of Experiment, Inc., Richmond, has been invited to participate in the Second Agard Combustion Colloquium to be held in Liege, Belgium on December 5-9. Recent additions to the staff of Experiment, Inc. include Claude P. Talley as Associate Scientist and Thomas E. Gilmer, Jr. as Senior Scientist. Mr. Talley is a graduate of the University of Richmond and was connected formerly with the duPont Company; Mr. Gilmer has completed recently the requirements for his Doctor's degree in Physics at the University of North Carolina.

Newcomers to the Research Department of the Virginia-Carolina Chemical Corp., Richmond, include the following: Dr. Borgislav G. von Schmeling, biologist, graduate of the University of Munich; Dr. Joseph Matt, organic chemist, graduate of the University of Pennsylvania and Purdue University, formerly with Armour and Company; Dr. Wendell M. Byrd, Jr., graduate of Antioch College and Ohio State University and also a post-doctoral fellow at Antioch before joining V-C; Dr. William R. Smithey, fiber chemist, graduate of Virginia Military Institute and the University of Virginia, former Professor of Organic Chemistry at Birmingham-Southern College; Dr. Allan D. Gott, fertilizer chemist, graduate of the University of the South and the University of Illinois, formerly with Mallinchrodt Chemical Works; Edwin G. Hardin, market research coordinator, graduate of Davidson and Clemson colleges and Instructor in Chemistry at Clemson; and Ray S. Mathews, biologist, graduate of Tennessee Polytechnic Institute and Peabody College, formerly with the U. S. Government Agricultural Research Service.

Harrison Tyler, formerly development engineer with V-C in Charleston, South Carolina, and Cincinnati, Ohio, has joined the Chemicals Division Technical Service group in Richmond. Dr. Russell J. Rowlett, patent coordinator, has been made Assistant Director of Research.

Victor J. Kehrer has resigned from the Virginia Institute for Scientific Research to accept a position with the Solvay Company in Syracuse, New York. G. Wayne Clark has joined the VISR staff as a Research Physicist. Dr. Clark is a graduate of Clemson College and of the University of Virginia, and was formerly associated with Linde Air Products in Tonawanda, N. Y.

CARL J. LIKES, *Virginia Institute for Scientific Research*

ENGINEERING SECTION

The chairman of the Engineering Section for 1955-1956, Dr. Dudley Thompson of Virginia Polytechnic Institute, resigned his position effective at the end of 1955 to accept the position of chairman of the chemical engineering department and Professor of Chemical Engineering at Missouri School of Mines and Metallurgy, in Rolla, Missouri. During the few months of 1956 until the annual meeting of the Academy, Dr. N. F. Murphy and Dr. R. W. Truitt of Virginia Polytechnic Institute, both past chairmen of the Engineering Section will serve as co-chairmen of the Section.

Mr. Phillip Melville, past chairman of the Section, has resigned his position with the Virginia Council for Highway Investigation and Research at the University of Virginia and is now a civil engineer with the U. S. Corps of Engineers, Airfield Branch.

Professor Dan H. Pletta of Virginia Polytechnic Institute spoke to the Blacksburg chapter of the Virginia Society of Professional Engineers late in June on the subject "The Engineering Curricula of the Future". Professor Pletta recently served as secretary of the A. S. E. E. Committee on Evaluation of Engineering Education. Professor Dudley Thompson was the author of Virginia Polytechnic Institute Engineering Experiment Station Bulletin No. 100 on the subject "Application of Dimensional Analysis to the Relationship between Velocity of Sound and Physical Properties in Organic Liquids".

Professor Lawrence R. Quarles of the Electrical Engineering Department of the University of Virginia assumed the position of Dean of the School of Engineering on September 1, 1955. During the past year he has served as Assistant Dean of that School. In June Professor Quarles attended the annual meeting of the American Society of Engineering Education at State College, Pennsylvania. During the fall months he spoke before the Charlottesville chapter of the Virginia Society of Professional Engineers, the Richmond subsection of the American Institute of Electrical Engineers, and the Executive Committee of the Virginia Press Association on the subject "The University and Atomic Energy".

Mr. Tilton E. Shelburne of the Virginia Council of Highway Investigation and Research at the University of Virginia served in October on the advisory panel to a Government Advisory Committee on International Technological Asistance with reference to a survey of scientific institutions in India.

Professor Otis L. Updike, Jr. of the University of Virginia returned in September to his position in the chemical engineering department after leave of absence for a year during which he was associated with the Naval Air Missile Testing Center at Point Mugu, California. He obtained considerable experience in the application and operation of electronic computers.

Professor Orville R. Harris of the University of Virginia attended the second annual meeting of the Professional Group on Nuclear Science of the Institute of Radio Engineers and presented a paper on the subject "Phototube Regulators for Scintillation Counters". Professor Robert M. Hubbard of the University of Virginia attended the third summer school for teachers of chemical engineering sponsored by the A. S. E. E. at Pennsylvania State College in June. Professor R. E. Lee Gildea of the University of Virginia attended the national meeting of the American Society of Civil Enginers in New York in November where he served as a delegate to a conference of faculty advisers to student chapters of that organization.

—ROBERT M. HUBBARD, *University of Virginia*

GEOLOGY SECTION

In October, 1955, the Council of Administration of the Virginia Polytechnic Institute approved a change in departmental name of the department of geology to Department of Geological Sciences. This change signalizes the diversification of activities of the department's instructional program and research work which has been taken place during the past nine years. The department now offers graduate and undergraduate instruction in geology, geophysics, geochemistry, and engineering geology.

Geology and Mineral Deposits of the James River–Roanoke River Manganese District, Virginia, by Gilbert H. Espenshade has been issued as U. S. G. S. Bull. 1008. The geology and manganese deposits of this interesting central Piedmont area are treated.

Additions to Virginia Mineral Locations by R. V. Dietrich, Associate Professor of the Department of Geological Sciences and Associate Mineral Technologist of the Virginia Engineering Experiment Station, has been published as Bulletin No. 105 of the Engineering Experiment Station Series of the Virginia Polytechnic Institute. This bulletin includes more than 150 entries including 31 minerals and varieties that were not reported in *Virginia Mineral Locations* (Bull. No. 88). Unlike the previous bulletin, many minerals reported in this bulletin have not been reported elsewhere in the literature. Many of these minerals were identified in the mineralogical laboratories at Virginia Polytechnic Institute. The bulletin includes an appendix that gives the "Check List of Virginia Minerals" and also an appendix that lists many of the minerals reported in Virginia by county. Virginia's check list of minerals now includes more than 325 mineral species and varieties. This bulletin is available from the Director of the Virginia Engineering Experiment Station.

Geology of the Otter River Area, Bedford County, Virginia, by William E. Diggs, former Research Assistant of the Virginia Engineering Experiment Station Series of the Virginia Polytechnic Institute. This bulletin constitutes a thesis submitted to the graduate faculty of Virginia Polyechnic Institute in partial fulfillment of the degree of Master of Science in Geology. The bulletin considers the geology of a forty-square-mile area in Bedford County of the Piedmont of Virginia. The area mapped is underlain by metamorphic gneisses and schists. The bulletin is accompanied by a map on the scale of approximately two inches to the mile. This bulletin is available through the Director of the Virginia Engineering Experiment Station.

Guides to Southeastern Geology, edited by R. J. Russell, was prepared in conjunction with the annual meeting of the Geological Society of America held in New Orleans, Louisiana. This publication includes road logs for routes 11, 29, 250, and connecting routes through Virginia. The geological features along route 11, from the Virginia—West Virginia line to the Virginia—Tennessee line were described by B. N. Cooper. The features along highways 50, 29, 250 and 340 between Washington, D. C., and Staunton, Virginia, and those along highway 15 between Point of Rocks,

Maryland, and the junction of highways 15 and 29 were described by R. V. Dietrich and W. D. Lowry.

Leonard Harris, U. S. G. S. geologist, is mapping the Duffield, Virginia quadrangle most of which is in Scott County. The mapping is a current project of the Fuels Branch of the Geological Survey.

B. N. Cooper, Chairman of the Southeastern Section of the Geological Society of America, was recently elected to the Council of the GSA for a three-year term ending in 1958. The council is the governing body for the Geological Society of America. B. N. Cooper also presented a talk entitled, "Geology and Mineral Deposits of the Southeastern Appalachian States" at the opening session of the annual meeting of the Industrial Mineral Division of the A. I. M. E. at Charlotte, N. C., October 27. He cited numerous instances of how geological research has promoted industrial expansion. His paper was a plea for more geological investigation in this region.

The annual meetings of the Geological Society of America held at the Roosevelt Hotel, New Orleans, Louisiana, were attended by Drs. Byron N. Cooper, Wayne E. Moore, and Bruce W. Nelson of the Virginia Polytechnic Institute Department of Geological Sciences. Drs. Nelson and Moore participated in a field trip to the Mississippi delta region and presented papers at the paleontology and sedimentation sessions. Dr. Moore discussed some new laboratory observations on foraminifera ecology in a paper entitled: "Live Foraminifera from Crane Key, Florida." Dr. Nelson's paper was entitled "Mineralogy of the Bedford Formation and Related Rocks in Northern Ohio," and dealt with stratigraphic clay mineral variations.

Dr. C. I. Rich and Dr. R. D. Krebs, both of the Virginia Polytechnic Institute Department of Agronomy, and Dr. B. W. Nelson of the Department of Geological Sciences attended the Fourth National Clay Minerals Conference which was held at Pennsylvania State University, State College, Pennsylvania, on October 10-13. About two hundred scientists from the fields of mineralogy, geochemistry, agriculture, chemistry, and physics met under the sponsorship of the National Research Council to discuss current research in clay mineralogy and clay technology. Overseas scientists from England, Belgium, France, Spain, Germany, Japan, and Australia participated. In addition to papers of general interest, symposia were held on clay-water relationships, mixed-layer clays, and thermal transformations in clays. Dr. B. W. Nelson presented a paper at the Symposium on "Thermal Transformations". Dr. C. I. Rich, Associate Agronomist at the Virginia Agricultural Experiment Station at Virginia Polytechnic Institute, has been appointed to the committee on Soil Mineral Analysis Methods of the Soil Science Society of America. This committee is to make recommendations for improvement of and more or less standardization of mineral analyses methods (especially of clay minerals) reported in papers printed by the society. The committee also hopes to establish a system of nomenclature for clay minerals that will be used in publications of the society.

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Ralph L. Miller, Chief of Fuels Branch, U. S. Geological Survey, and W. D. Lowry, professor of geology, Virginia Polytechnic Institute, were guest speakers at the annual meeting of the Appalachian Geological Society held at Charleston, West Virginia, November 18. The theme of the meeting was "Cambro--Ordovician Oil and Gas Possibilities in the Appalachian Region".

Dr. Miller described the "Cambro-Ordovician Section of Southwestern Virginia" which includes the Rose Hill oil field of Lee County where the Trenton limestone is the producing formation. He noted the petroliferous character of the Copper Ridge dolomite, which as yet is unproductive, and stressed the incompleteness of our knowledge of the stratigraphy of the area because of the relative small area of outcrop.

Professor Lowry discussed "Factors in Loss of Porosity by Quartzose Sandstones of Western Virginia". He pointed out that the sutured texture of these sandstones, ranging in age from Cambrian to Pennsylvania, was developed as a result of solution of silica at grain contacts and concurrent precipitation of that silica in the pore spaces. Little or no silica was introduced from outside. This type of cementation, called welding, results in a reduction in volume and pore space and is a direct response to stresses produced by deep burial or deforming forces. Professor Lowry also noted the inapplicability of recent experiments dealing with the loss of porosity by deeply buried sands because no consideration was given to the increase in area of contact between grains as a result of partial welding prior to really deep burial. He stressed that the oil and gas possibilities of the early Paleozoic sandstones of western Virginia have not been adequately tested and pointed out that these sandstones in places may retain part of their origianl porosity and permeability if they were originally well sorted and coarse grained and oil or gas had migrated into them prior to deep burial or strong deformation. He stated that he believes migration would have been favored by gentle warping contemporaneous with or not long after deposition; evidence supporting such warping in Ordovician time was cited.

A lifelike *Brontosaurus* with flashing eyes and smoking nostrils comprised the float constructed by the Holden Society which won first prize in Virginia Polytechnic Institute's homecoming parade. Two cave women and two cave men wearing animal hides accompanied the brontosaur in the parade. The captions appearing on the float were "Welcome back, '05, From One Old Fossil To Another", and "I Was Here In 1905--When Tech Used Clubs and Stones; Now I'm Back In '55--To Eat G. W.'s Bones".

--W. D. LOWRY, *Virginia Polytechnic Institute*

PSYCHOLOGY SECTION

In the interest of encouraging and maintaining the high professional standards of psychologists in the State, the Chairman of the Psychology Section has appointed a Committee on Professional Ethics. This committee is empowered to investigate and act upon an alleged violation of pro-

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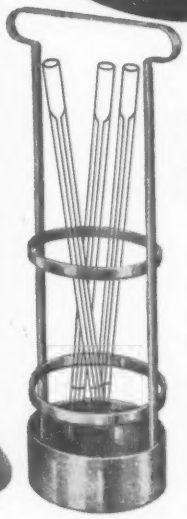

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fessional conduct by psychologists. Members of this committee are David H. Orr, chairman; Arthur J. Bachrach, Merton E. Carver, Hiram L. Gordon, and Cyril R. Mill. Persons wishing to make contact with this committee may do so by writing the chairman at Eastern State Hospital, Williamsburg, Virginia.

Miss Marjorie Brownell has returned to Randolph-Macon Woman's College after a sabbatical leave of absence spent at the University of Massachusetts doing research for the Ph.D. in experimental psychology.

The following psychologists have been appointed to the Constitutional Committee authorized at the business meeting of the Section in May: William J. Morgan, chairman; Richard H. Henneman, Reuben S. Horlick, Gilbert J. Rich, Jacob Silverberg, and Stanley B. Williams. A first meeting of this committee was held on November 13, at which time a tentative constitution was drafted.

At the 1955 meetings of the American Psychological Association in San Francisco in September, Frank W. Finger of the University of Virginia was chairman of a symposium on Problems in Research in Undergraduate Teaching of Psychology, sponsored by the Division on the Teaching of Psychology. Mr. Finger is president-elect of this division of the A. P. A. He also chaired a session of theoretical papers on the program of the Division of General Psychology. Frank A. Geldard also attended the meetings as a member of the A. P. A. Council. He is currently president of the Division of Experimental Psychology. Reuben S. Horlick was chairman of a symposium on Theoretical and Psychological Aspects of Aphasia, sponsored by the Division of Clinical Psychology.

Virginia Psychologists were active at the Atlanta meetings of the A. A. A. S. in December. John F. Hahn of the University of Virginia presided over a session of invited papers on Sensory Processes, co-sponsored by Section I of the A. A. A. S. and the American Physiological Society. Frank A. Geldard presented a paper, Sensory Potentials of the Human Skin, at this session. William J. Morgan of Aptitude Associates presented at another session on the Section I program, a paper on the Development and Standardization of a Verbal Intelligence Test for College Graduates.

A Center for Psychological Services has been opened at the University of Richmond. Functions of the Center include vocational and personal counseling, research on problems of student adjustment, remedial programs, and student advisory services. The Center also offers consulting services to the Richmond community. The staff of the Center includes J. E. Williams, acting director; R. F. Filer, coordinator of community services, and M. E. Carver.

John J. McMillan, McGuire Hospital, has accepted a new position with the Research Grants and Fellowship Section of the National Institute for Mental Health in Bethesda, Maryland, effective January 1, 1956. Robert O. Hatfield, Ph.D., has joined the Child Care Bureau of the State Department of Welfare and Institutions in Richmond. He is a member of the team which makes up the Mobile Psychiatric Clinic. Mr. Hatfield was assistant professor of psychology at North Carolina State College and ob-

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tained his doctoral degree from the University of Denver. John McBride, formerly psychologist at Central State Hospital, has joined the staff at the Educational Therapy Center, Richmond.

New appointments in the School of Clinical and Applied Psychology of the Richmond Professional Institute include R. Omer Lucier, Ph.D., Donald P. Ogdon, Ph.D., Nicholas M. Vincent, Ph.D., Dell Lebo, M.A., and Edwin R. Thomas, M.S., who had been on leave of absence at Syracuse University.

Mr. Peter Guthrie began his duties as Assistant Professor of Psychology at the College of William and Mary in September. He is finishing his doctoral dissertation for the Ph.D. at Brown University. Mr. Albert Pawlowski has joined the Department of Psychology at the College of William and Mary as Assistant Instructor with special responsibilities for the rats, the laboratories and the shop. He holds an M.A. from the University of Connecticut.

William M. Hinton of Washington and Lee University has been serving as a consultant in counseling psychology for the Central Office of the Veterans Administration in Washington.

Miss Alice Van Krevelen has resigned from the faculty of Hollins College to accept a position with the Department of Psychology at Grinnell College in Iowa. Mr. F. Joseph McGuigan and Mr. Allen D. Calvin have joined the Department of Psychology at Hollins College.

New members of the psychological staff at Veterans Administration Hospital, Roanoke, are Philip Himelstein, William Eichman and Earl Guyer.

—RICHARD H. HENNEMAN, *University of Virginia*

STATISTICS SECTION

The Southern Regional Education Board, at a meeting on October 6, formally organized the Section on Statistics which is composed of eleven colleges and universities throughout the South. In general, these are the universities which offer Ph.D. degrees in the field of Statistics either as a major or a minor. Dr. Boyd Harshbarger was elected the first Chairman of this group. Dr. John K. Folger was elected Secretary. Among the plans of the committee is a regional meeting of statisticians in the South sometime during the year 1956.

Boyd Harshbarger attended the Council Meeting of the American Statistical Association in New York on October 28. He will chairman one of the Sections on Statistics in New York at the Annual Meeting of the American Statistical Association on December 27-30.

The Department of Statistics of the Virginia Polytechnic Institute began the session of 1955-56 with twenty-eight graduate students, fourteen of whom are working toward their Ph.D. degrees in Statistics. This is probably the largest group of graduate students in Statistics in the United States and one of the best prepared groups of students ever assembled at the Virginia Polytechnic Institute.

Profesor M. C. K. Tweedie attended the Third Symposium on Mathemati-

cal Statistics and Probability at the University of California at Berkeley during the summer. The Department of Statistics at the Virginia Polytechnic Institute has been awarded a grant by the National Science Foundation for research on statistical estimation theory. Professor Tweedie is the principal investigator under this grant.

Dr. John E. Freund attended the American Society for Quality Control meeting in Chattanooga on November 4. He presented a paper entitled "Statistical Thinking".

Dr. F. S. McFeely received his Ph.D. degree from the Department of Statistics of the Virginia Polytechnic Institute in August. He has accepted a position with the Child Research Council in Denver, Colorado.

Professor Clyde Y. Kramer was the author of a paper entitled "A Method for Choosing Judges for a Sensory Experiment" which appeared in *Food Research*. He is also a joint author of a paper entitled "Application of a Latin Square Change-Over Design to Dairy Cattle Grazing Experiments" which appeared in the *Journal of Dairy Science*.

Dr. W. A. Thompson, Jr. has resigned his position in the Department of Statistics of the Virginia Polytechnic Institute to take a position with Headquarters Continental Command, Fort Bliss, Texas.

Mr. H. C. Sweeny, formerly of the Virginia Polytechnic Institute, has accepted a position with Atlantic Refining Company, Philadelphia, Pennsylvania effective September 1955.

Mr. Willard O. Ash, formerly Assistant Professor of Statistics at the University of Maryland, is now Assistant Professor in the Department of Statistics at the Virginia Polytechnic Institute.

Mr. Paul D. Minton is now Associate Professor in the Department of Statistics of the Virginia Polytechnic Institute. He is on leave of absence for a year from Southern Methodist University, Dallas, Texas, where he was Assistant Professor in the Department of Mathematics.

Mr. Thomas S. Russell, Dr. Boyd Harsharberger, and Dr. John E. Freund attended the Conference on Design of Experiments in Army Research, Development, and Testing sponsored by the Diamond Ordnance Fuze Laboratories and the National Bureau of Standards, Washington, D. C., on October 19-21, 1955.

Among those presenting papers at the Annual Meeting of the American Statistical Association in December were J. E. Freund, M. C. K. Tweedie, D. E. W. Schumann, R. L. Wine, and R. J. Freund, all of the Department of Statistics of the Virginia Polytechnic Institute.

Charles C. Beazley finished his Master's degree in Statistics at the Virginia Polytechnic Institute in June and is now with Central Laboratories, General Foods Corporation, Hoboken, New Jersey.

Elwood L. Bombara received his Master's degree in Statistics from the Virginia Polytechnic Institute in June. He is now a 2nd Lieutenant with the Rocket Development Division, 9330 TU, Redstone Arsenal, Huntsville, Alabama.

Robert J. Taylor received his Master's degree in Statistics at the Virginia

Polytechnic Institute in June. He is now with the Naval Research Laboratory in Washington, D. C.

Dr. R. L. Wine is working on an area survey together with appropriate statistical theory to determine where farmers and their wives get their information for certain farming and homemaking practices in Virginia.

Norbert L. Enrick, head of the Statistics Department, Institute of Textile Technology, Charlottesville, Virginia, gave a paper at the Annual Convention of the American Society for Quality Control on "Textile Applications of Statistical Quality Control," based on actual installation experience in over 50 plants over the past ten years. He also completed a lecture tour this summer, through North Carolina, South Carolina, and Georgia, in which he presented actual examples of successful mill uses of statistical quality control.

His series of articles on "Quality Control through Statistical Methods" has been issued in book form by Modern Textiles Magazine and Rayon Publishing Corporation. The current series on "Modern Mill Controls" is likewise scheduled to be issued in book form.

Mr. Enrick has been appointed Chairman of the Task Group on Yarn Evenness Testing of the American Society for Testing Materials, Committee D-13, B-8 (Formerly B-1). Electronic testers and variation computers of yarn unevenness represent a specialized field of statistical applications, to which he has contributed a number of papers and new methods of evaluation.

The Sixth Annual Conference of the Textile Division, American Society for Quality Control, will be held next February 13, 14, and 15, at the Institute of Textile Technology, Cramer Auditorium, under the general chairmanship of Dr. J. Compton and program chairmanship of N. L. Enrick.

—LIONEL WEISS, *University of Virginia*